PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

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Knight	93SX312	288-5
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Sparton	17A203, 17A204, 18A203, 18A204, 19A203, 19A204, 19A209, 19A210, 20T203, 20T204, 20T209, 20T210, 20T403, 20T404, 21T203, 21T204, 22A403, 22A404, 24T201, 24T202, 24T301 (Ch. 22V174B, 22V214B, 23U174B, 23U214B) Tel. Rec.	288-9
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Wells-Gardner	321AM51-A-432, 321AM51-A-486, 2321AM51-A-488 Tel. Rec.	288-11

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SUPPLEMENTAL DATA TO PHOTOFACT FOLDER 10 IN SET 240

Trav-Ler models 317-44, A, 317-47, 321-46 and 321-48 were covered in Photofact Folder 10 — Set 240.

A complete list of all new models, chassis, picture tube and tuner used in each is given below.

MODEL	CHASSIS	PICTURE TUBE	TUNER
317-47	46A4, 46D4	17HP4	TV-TA-9
317-47U	47A3	17HP4	TV-TA-12 & TV-TA-13
317-47UC	48A3, 48A4	17HP4	TV-TA-11
317-47U9	49A4, 49D4	17HP4	TV-TA-14
317-56	510A4	17HP4	TV-TA-15
317-67	510A4	17HP4	TV-TA-15
321-R45	46A3	21YP4	TV-TA-9
321-46	46A4	21YP4	TV-TA-9
321-46U	47A3	21YP4	TV-TA-12 & TV-TA-13
321-46UC	48A3, 48A4	21YP4	TV-TA-11
321-46U9	49A4	21YP4	TV-TA-14
321-48	46A4	21YP4	TV-TA-9
321-48U	47A3	21YP4	TV-TA-12 & TV-TA-13
321-48UC	48A3, 48A4	21YP4	TV-TA-11
321-48U9	49A4	21YP4	TV-TA-9
321-54	46A3, 46A4	21YP4	TV-TA-9
321-54UC	48A3, 48A4	21YP4	TV-TA-11
321-54U9	49A4	21YP4	TV-TA-14
321-55	46A3, 46A4	21YP4	TV-TA-9
321-55UC	48A3, 48A4	21YP4	TV-TA-11
321-55U9	49A4	21YP4	TV-TA-14
321-75	511A4	21YP4	TV-TA-16
321-76	511A4	21YP4	TV-TA-16
321-460	46A3, 46A4, 46D4	21YP4A	TV-TA-9
321-460UC	48A4	21YP4A	TV-TA-9
321-460U9	49A4, 49D4	21YP4A	TV-TA-14
321-480	46A3, 46A4, 46D4	21YP4A	TV-TA-9
321-480UC	48A4	21YP4A	TV-TA-11
321-480U9	49A4, 49D4	21YP4A	TV-TA-14
321-540	46A3, 46A4, 46D4	21YP4A	TV-TA-9
321-540UC	48A4	21YP4A	TV-TA-9
321-540U9	49A4, 49D4	21YP4A	TV-TA-14
321-770	511A4	21YP4A	TV-TA-16
324-49	46C3, 46C4	24TP4/24CP4A	TV-TA-9
517-56	510A4	17HP4	TV-TA-15
517-67	510A4	17HP4	TV-TA-15
521-75	511A4	21YP4	TV-TA-16
521-76	511A4	21YP4	TV-TA-16
521-77	511A4	21YP4A	TV-TA-16
521-78	511A4	21AUP4A	TV-TA-16
3210-60	46A4, 46D4	21YP4A	TV-TA-9
3210-60UC	48A4	21YP4A	TV-TA-11
3210-60U9	49A4, 49D4	21YP4A	TV-TA-14
3210-61	46A4, 46D4	21YP4A	TV-TA-9
3210-61UC	48A4	21YP4A	TV-TA-9
3210-61U9	49A4, 49D4	21YP4A	TV-TA-14

TRAV-LER CHASSIS 46A3, 46A4, 46C3, 46C4, 46D4, 47A3, 48A3, 48A4, 49A4, 49D4, 510A4, 511A4

CHASSIS IDENTIFICATION

Chassis 46A3 and 46B3 will be considered as the basic chassis . Following is a brief comparison of chassis; later in this bulletin all changes will be given.

Ch. 46A4 — Chassis 46A4 is electrically identical to chassis 46A3, except an aluminized picture tube is used in some models.

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Ch. 46C3, 46C4	Chassis 46C3 and 46C4 differ from chassis 46A3 in that the sweep components are changed to provide sweep for a 24TP4/24CP4A picture tube. A new tuner is also incorporated.
Ch. 46D4	Chassis 46D4 is electrically identical to chassis 46A3, except a different power transformer and a horizontal output transformer are used.
Ch. 47A3	Chassis 47A3 is electrically identical to chassis 46A3, except an all channel tuner is used, and a new IF strip is incorporated.
Ch.48A3, 48A4	Chassis 48A3 and 48A4 are identical to chassis 47A3, except a different tuner is used, and some models use an aluminized picture tube.
Ch. 49A4	Chassis 49A4 is electrically identical to chassis 47A3, except a different tuner is used.
Ch. 49D4	Chassis 49D4 is electrically identical to chassis 47A3, except a different tuner, power transformer and horizontal output transformer are used.
Ch.510A4 511A4	Chassis 510A4 and 511A4 are identical to chassis 46A3, except a different tuner, power transformer and sweep components are used.
	COMPONENT CHANGE The following changes covers all models and chassis. The vertical linearity control (R6) may be 5000Ω (part #TV-TC-29). When this control is used, R66 is decreased to 390Ω. R95 is increased from 1Meg to 1.3Meg in some chassis. C85, C87 and C88 are omitted in late production models. L9 and L11 are omitted in some chassis.
Ch.46A4	A complete and concise comparison of chassis follows: Chassis 46A4 is electrically identical to chassis 46A3, except an aluminized picture tube (21YP4A) is used in models 321-480, 321-480, 321-540, 3210-60 and 3210-61.
Ch. 46D4	Chassis 46D4 is electrically identical to chassis 46A3, except for the following changes. The power transformer (T1) is changed to part #TV-TR-13. The contrast and volume control (R1) is changed to part #TV-VC-60A. A .01MFD capacitor is added from the center arm of the volume control (R1B) to the grid of the AF amplifier (pin 1 of V10). A 2.2Meg resistor is added from pin 1 of V10 to ground. C79, C80, R90 and T6 (horizontal linearity coil) are omitted and a 6CU6 replaces V17. A partial schematic is given in Fig. 1 showing the new circuit.
Ch.46C3, 46C4	Chassis 46C3 and 46C4 are electrically identical to chassis 46A3, except for the following changes. Chassis 46C3 and 46C4 use sweep components capable of handling 90 degree deflection. The power transformer (T1) is changed to part #TV-TR-13. The deflection yoke (T5) is changed to part #TV-L-51. The horizontal output transformer (T3) is changed to part #TV-X-131. The picture tube is changed to a 24TP4/24CP4A. R71 is decreased from 4.7KΩ to 2.2KΩ. A 1000Ω resistor in series with a .02MFD capacitor is added from the junction of C63 and C64 to pin 1 of the vertical oscillator (V14). In later production models this network is replaced by a 680MMF mica capacitor connected from the plate of the vertical oscillator (pins 1-5 of V14) to ground. C76 is increased from 470MMF to 1000MMF. V17 changed from a 6BQ6GT to a 6CD6G. R86 is increased from 47Ω to 100Ω. C77 is increased from .05MFD to .25MFD. R87 and R88 are replaced by a 10KΩ, 5 watt resistor. C81 and R94 are omitted. R85 is increased from 470KΩ to 1Meg. PM focus is used and pin 10 of V21 is connected to the 350V line. R40 and R41 are omitted.

	The vertical output tube (V15) is changed to a 6BL7GT. A partial schematic shown in Fig. 2 shows the new arrangement. The vertical output transformer (T4) is changed to part #TV-TR-8A.
Ch. 47A3	Chassis 47A3 is electrically identical to chassis 46A3, except for the following changes. Chassis 47A3 is a UHF-VHF set. Tuner TV-TA-12 and TV-TA-13 is used. A schematic of this tuner is given in Fig. 4. A new IF strip is also employed. A partial schematic is shown in Fig. 3.
Ch. 48A3, 48A4	Chassis 48A3 and 48A4 are electrically identical to chassis 47A3, except for a different tuner (part #TV-TA-11). A schematic of this tuner is given in Fig. 5. An aluminized picture tube (21YP4A) is used in models 321-460UC, 321-480UC, 321-540UC, 3210-60UC and 3210-61UC.
Ch. 49A4	Chassis 49A4 is electrically identical to chassis 47A3, except a different tuner (part #TV-TA-14) is used. A schematic of this tuner is shown in Fig. 6. An aluminized picture tube is used in models 321-460U9, 321-480U9, 321-540U9, 3210-60U9 and 3210-61U9.
Ch. 49D4	Chassis 49D4 is electrically identical to chassis 47A3, except for the following changes : An all channel tuner (part #TV-TA-14) is used. A schematic of this tuner is shown in Fig. 6. The power transformer (T1) is changed to part #TV-TR-13. The horizontal output transformer is changed to part #TV-X-130A. A partial schematic showning the new horizontal output circuit is shown in Fig. 1. The contrast and volume control (R1) is changed to part #TV-VC-60A. A .01MFD capacitor is added from the center arm of the volume control (R1B) to the grid of the AF amplifier (pin 1 of V10). A 2.2Meg resistor is added from pin 1 of V10 to ground.
Ch. 510A4, 511A4	Chassis 510A4 and 511A4 are electrically identical to chassis 46A3, except for the following changes. The power transformer (T1) is changed to part #TV-TR-13. The deflection yoke (T5) is changed to part #TV-L-55. A new tuner (part #TV-TA-15) is used in chassis 510A4. Chassis 511A4 uses tuner part #TV-TA-16. A schematic of these tuners is shown in Fig. #7. C24 and C28 are omitted. R26 is decreased from 22KΩ to 15KΩ. R54 is increased from 100Ω to 470Ω. C72 is decreased from .02MFD to .01MFD. C78 is disconnected from pin 8 of V17 and connected to ground. A 470MMF capacitor is added from pin 1 of V14 to ground. Local-fringe switch is omitted. In chassis 511A4, C69 is increased from 4700MMF to .01MFD. A .01MFD capacitor is added from the center arm of the volume control (R1) to the grid of the AF amplifier (pin 1 of V10). A 2.2Meg resistor is added from pin 1 of V10 to ground. C79, C80, R90 and T6 (horizontal linearity coil) are omitted and a 6CU6 replaces V17. The horizontal output transformer is changed to part #TV-X-141A. A partial schematic showing the new circuit is given in Fig. 1. The brightness control (R4) is changed to part #TV-VC-57. The contrast and volume control (R1A and R1B) are single units in chassis 510A4 and 511A4. The contrast control changes to part #TV-VC-53, and the volume control changes to part #TV-VC-51. C41 and R33 are omitted. R31, which formerly connected to the low side of the contrast control, is now grounded. The center arm and the low end of the contrast control is also grounded.

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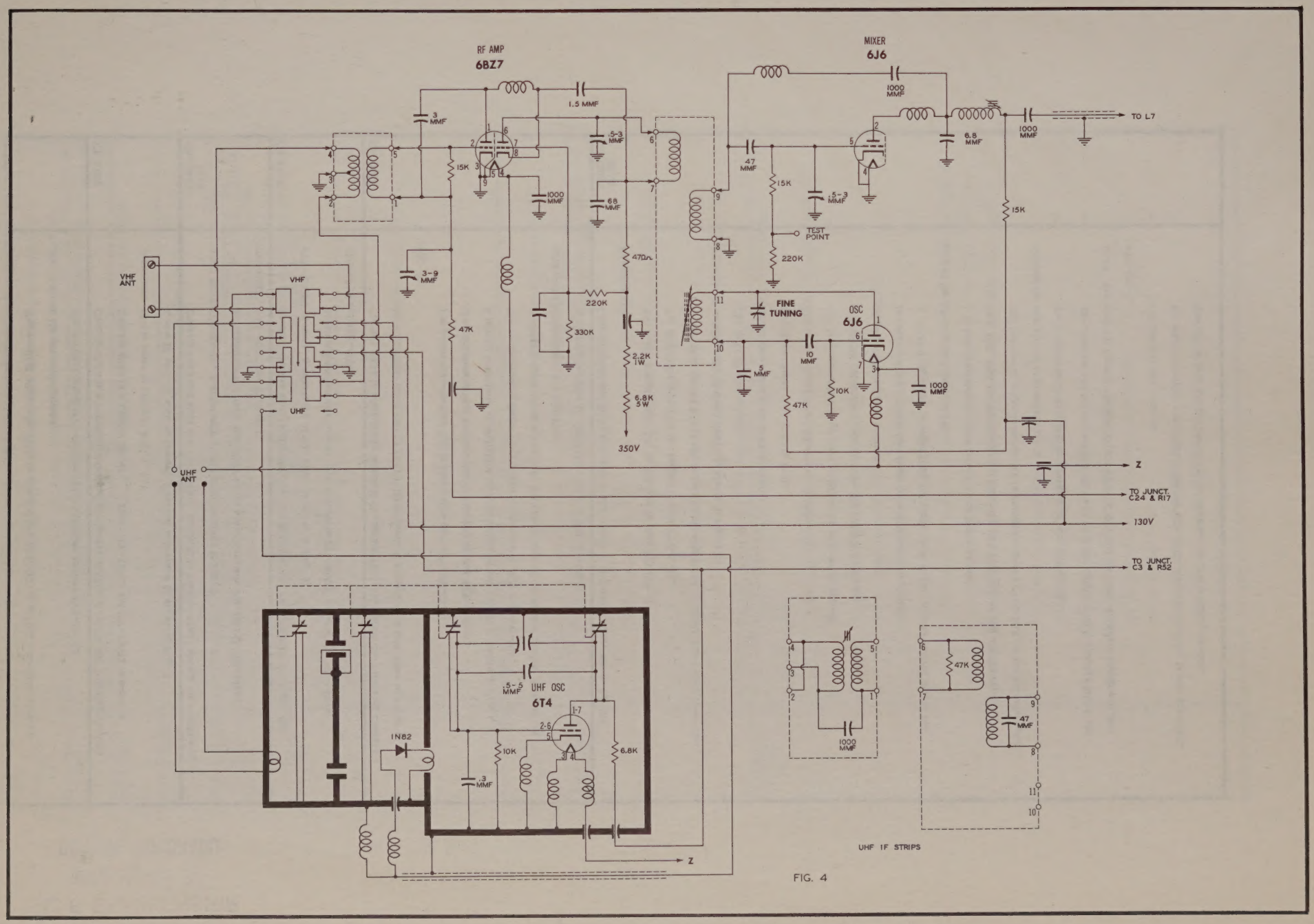
RF AMP
6BZ7
MIXER
6J6
OSC
6J6
VHF ANT
VHF
UHF
UHF ANT
FINE TUNING
TEST POINT
350V
TO L7
Z
TO JUNCT. C24 & R17
130V
TO JUNCT. C3 & R52
UHF OSC
6T4
1N82
UHF IF STRIPS

FIG. 4

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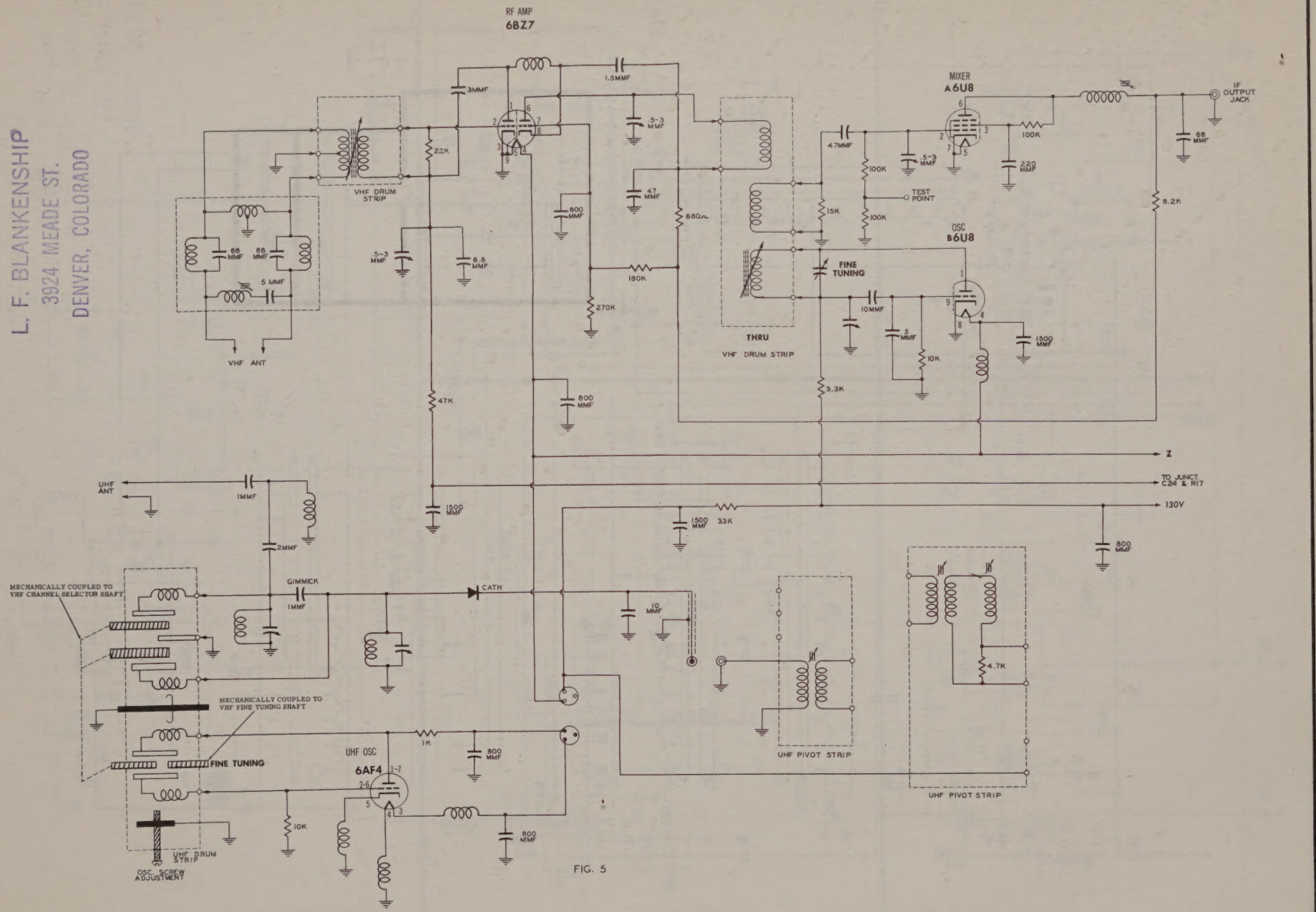

FIG. 5

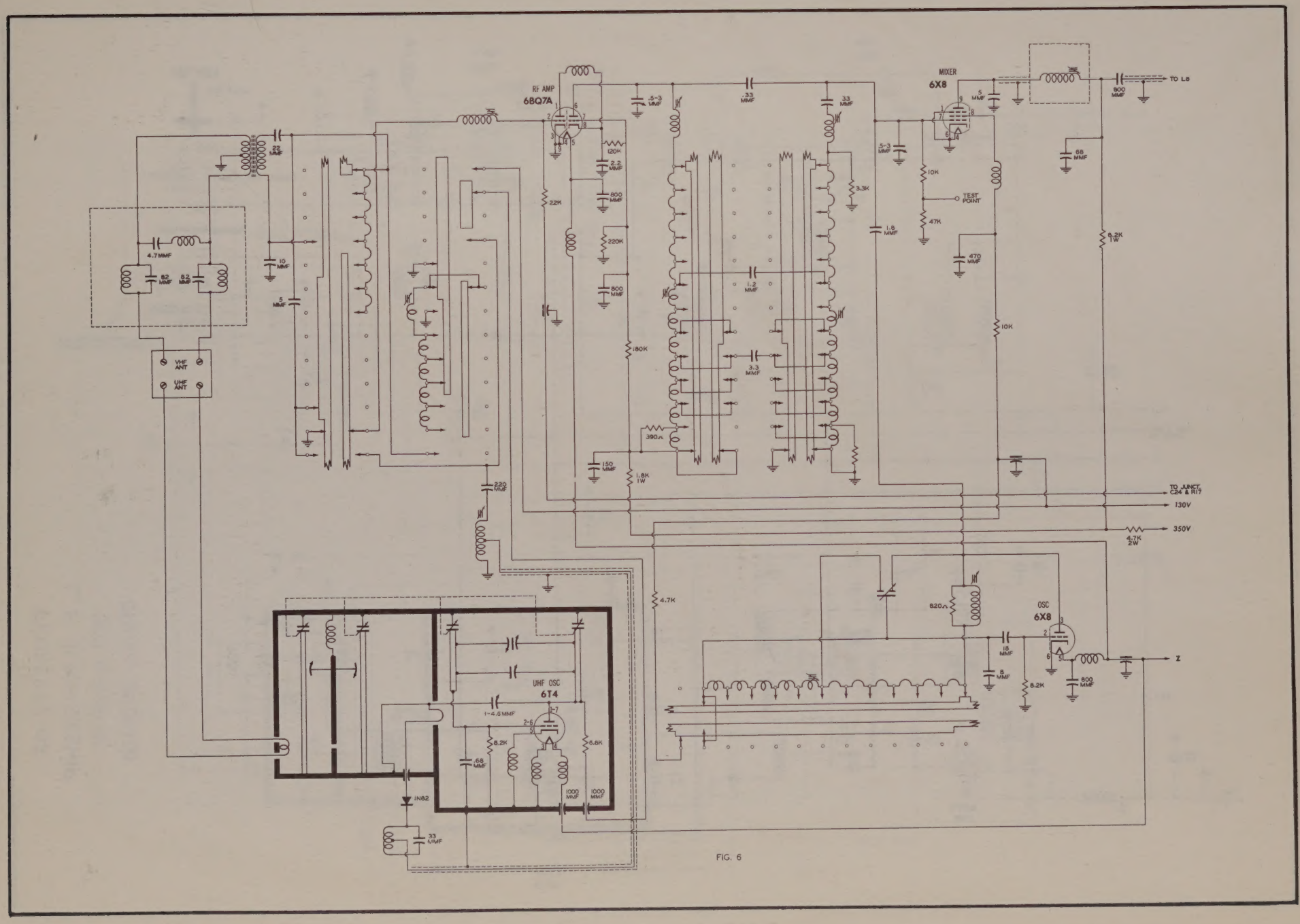
RF AMP
6BQ7A
MIXER
6X8
OSC
6X8
UHF OSC
6T4
TO L8
TEST POINT
VHF ANT
UHF ANT
TO JUNCT C24 & R17
130V
350V
IN82
4.7MMF
22 MMF
10 MMF
5 MMF
82 MMF
82 MMF
.5-3 MMF
.33 MMF
33 MMF
120K
2.2 MMF
800 MMF
22K
220K
180K
390Ω
150 MMF
1.8K 1W
220 MMF
4.7K
1.2 MMF
3.3 MMF
1.8 MMF
3.3K
10K
47K
470 MMF
68 MMF
9.2K 1W
10K
4.7K 2W
820Ω
18 MMF
8 MMF
8.2K
600 MMF
1-4.6MMF
8.2K
6.8K
68 MMF
1000 MMF
1000 MMF
33 MMF

FIG. 6

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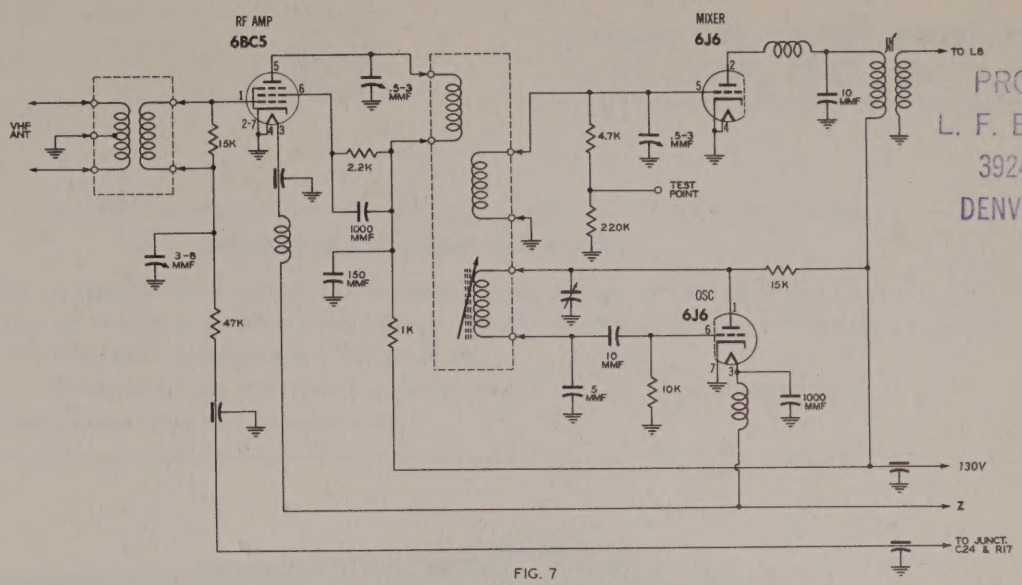


FIG. 7

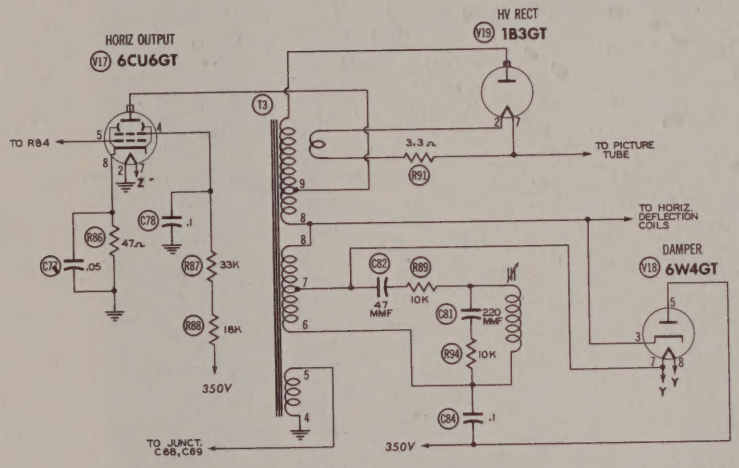


FIG. 1

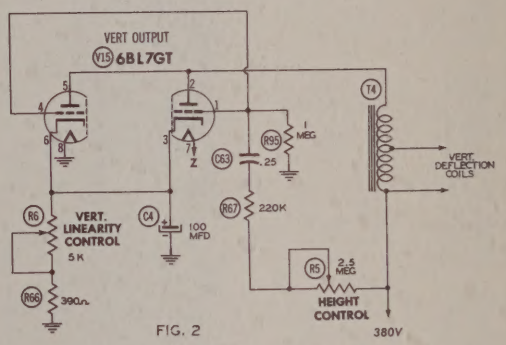


FIG. 2

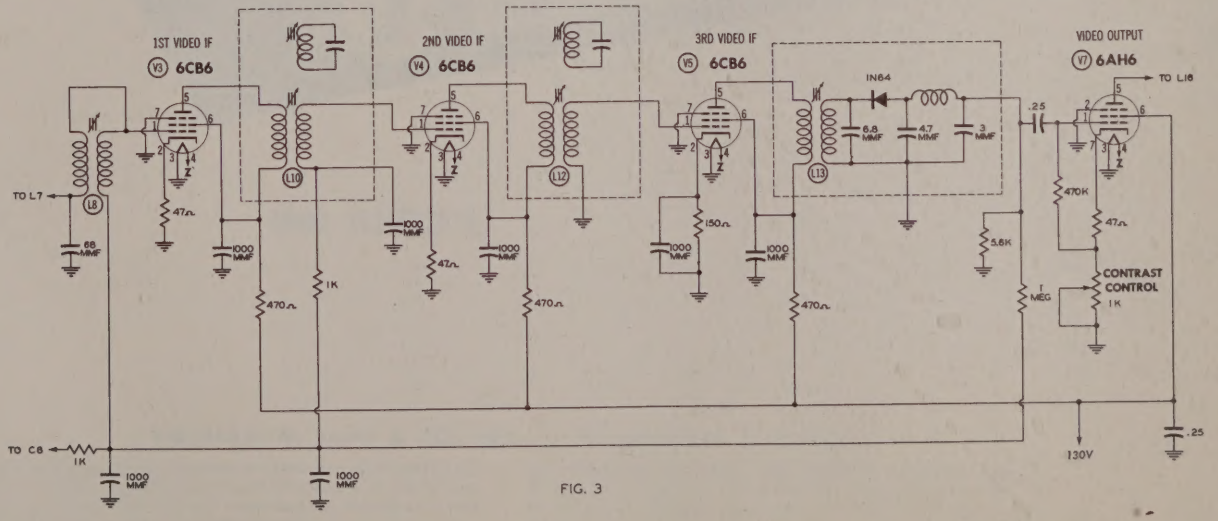
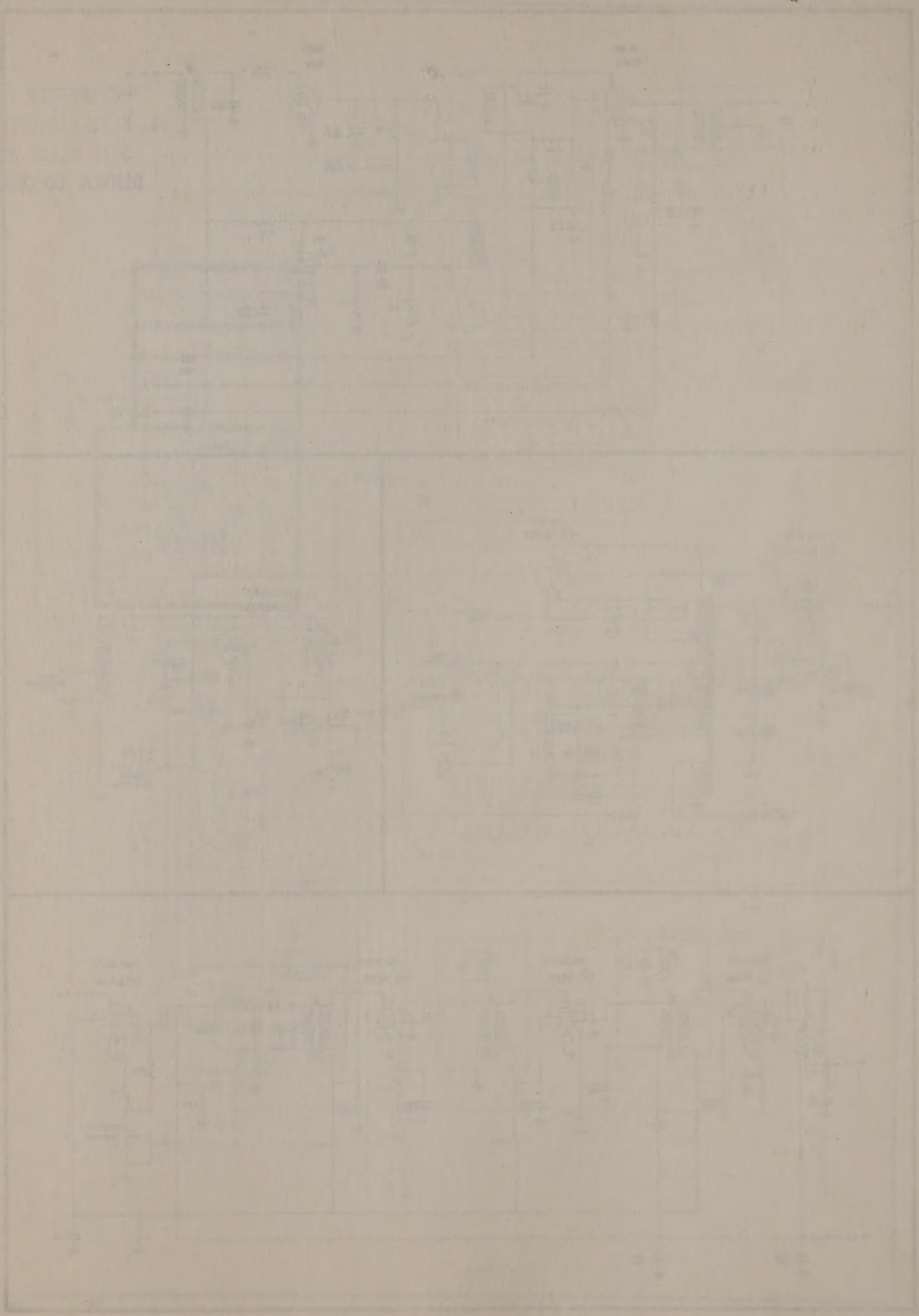


FIG. 3



PHOTOFACT* Folder

CAPEHART Ch. CT-109, CT-125, CT-139, CT-140, CT-157, CT-158, CT-171, CT-172 (CX-38 Series)

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Merely insert the corresponding folder on this model in this envelope to retain proper filing and indexing order.

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MODEL 2T215MSD-5

CAPEHART Ch. CT-109, CT-125, CT-139, CT-140, CT-157, CT-158, CT-171, CT-172 (CX-38 Series)

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DATE 9–55 SET 288 FOLDER 2

CAPEHART Ch. CT-109, CT-125, CT-139, CT-140, CT-157, CT-158, CT-171, CT-172 (CX-38 Series)

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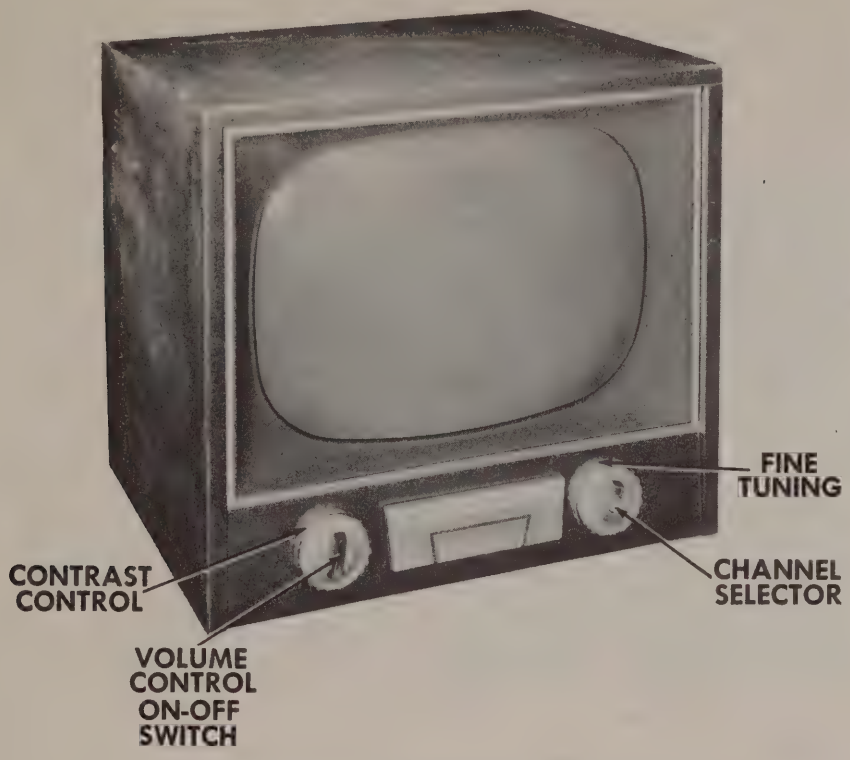

CAPEHART Ch. CT-109, CT-125, CT-139, CT-140, CT-157, CT-158, CT-171, CT-172 (CX-38 Series)

CAPEHART MODEL 2T215MSD-5 (Ch. CT-158)

TRADE NAME	Capehart	MODELS	CHASSIS
		1T175ES-4	CT-109 (CX-38 Series)
		2T215ES-4, 14F215B-4, 14F215M-4	CT-125 (CX-38 Series)
		1T175ES-5	CT-139 (CX-38 Series)
		2T215ES-5, 14F215B, -5, 14F215M-5	CT-140 (CX-38 Series)
		2T215BSD-4, 2T215MSD-4, 7C215B-4, 7C215BA-4, 7C215M-4, 7C215MA-4, 9C215BD-4, 9C215MD-4	CT-157 (CX-38 Series)
		2T215BSD-5, 2T215MSD-5, 7C215B-5, 7C215BA-5, 7C215M-5, 7C215MA-5, 9C215BD-5, 9C215MD-5	CT-158 (CX-38 Series)
		3T215BD-4, 3T215MD-4, 8C215BD-4, 8C215MD-4, 12F215BD, -4, 12F215MD-4, 18C215B-4, 18C215M-4	CT-171 (CX-38 Series)
		3T215BD-5, 3T215MD-5, 8C215BD-5, 8C215MD-5, 12F215BD-5, 12F215MD-5, 18C215B-5, 18C215M-5	CT-172 (CX-38 Series)

MANUFACTURER	Capehart-Farnsworth Corp., Fort Wayne, Indiana
TYPE SET	Television Receiver
TUBES	Twenty
POWER SUPPLY	110-120 Volts AC-60 Cycle RATING 1.62 Amp. @ 117 Volts AC
TUNING RANGE	Channels 2 thru 13 VHF, 14 thru 83 UHF, Video IF 45.75MC, Sound IF 41.25MC (Intercarrier)

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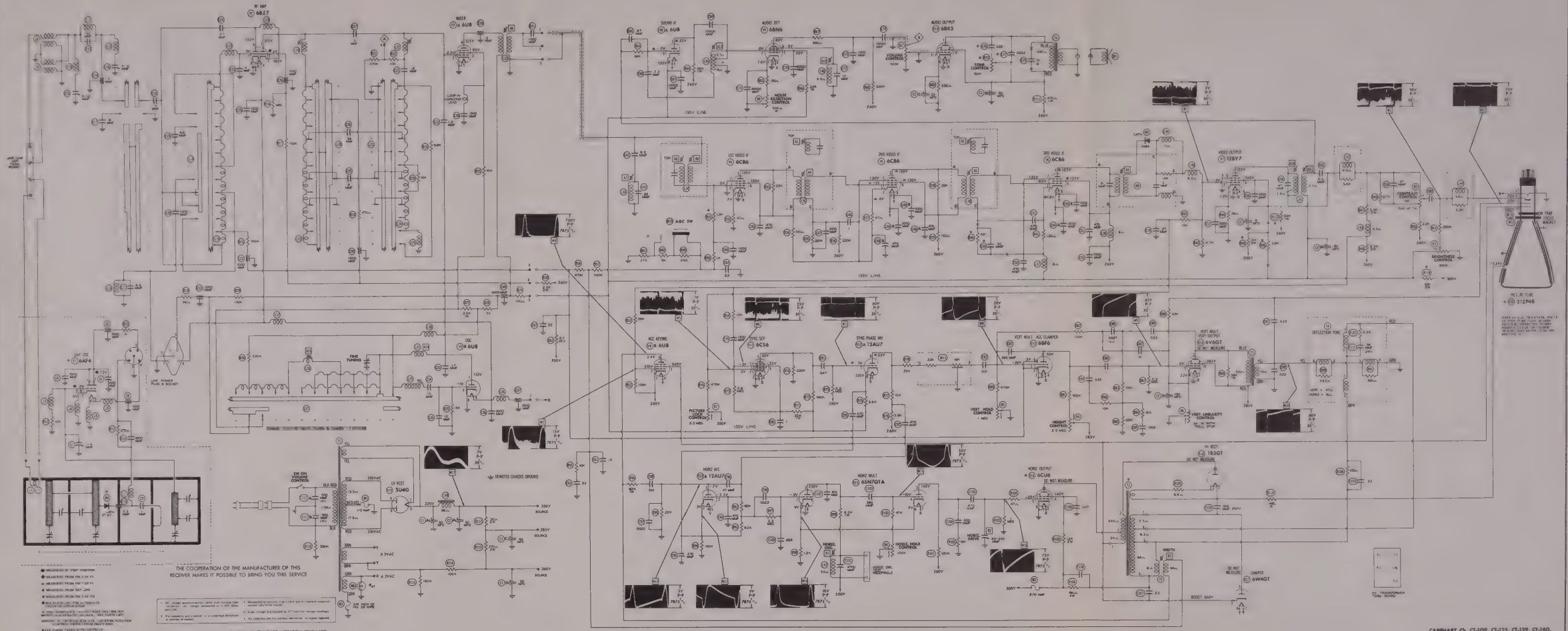
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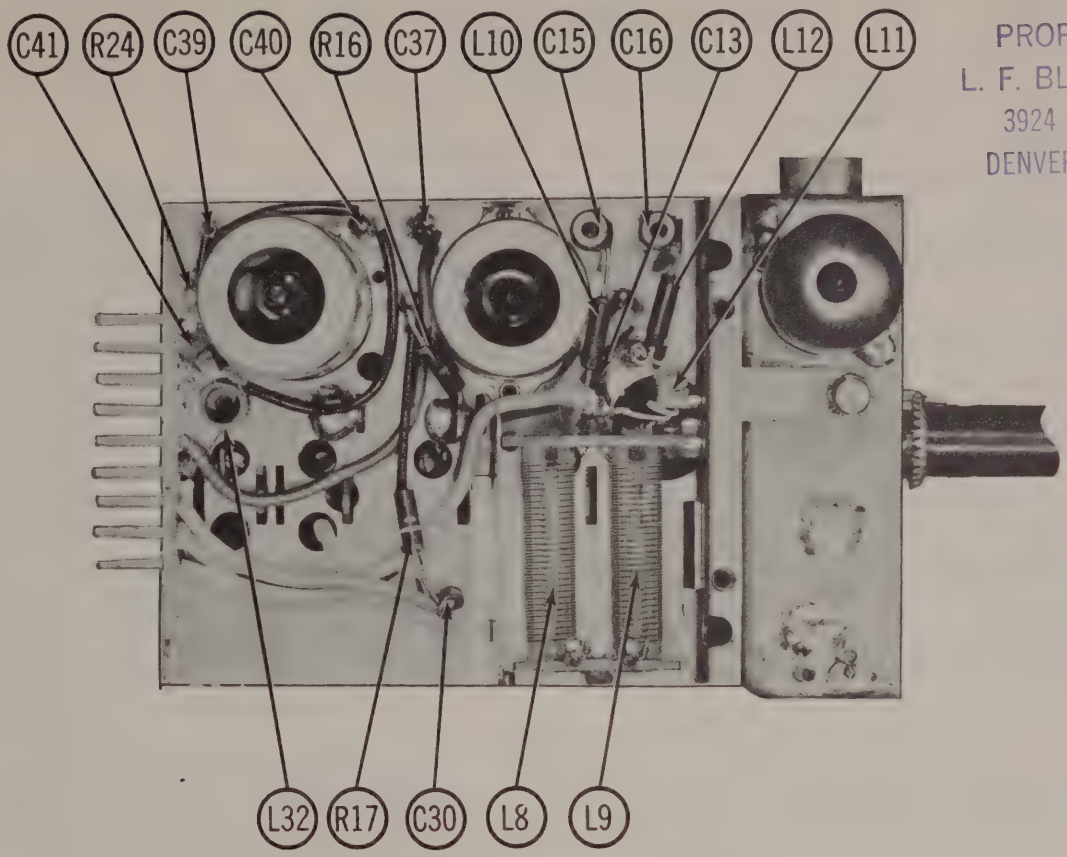
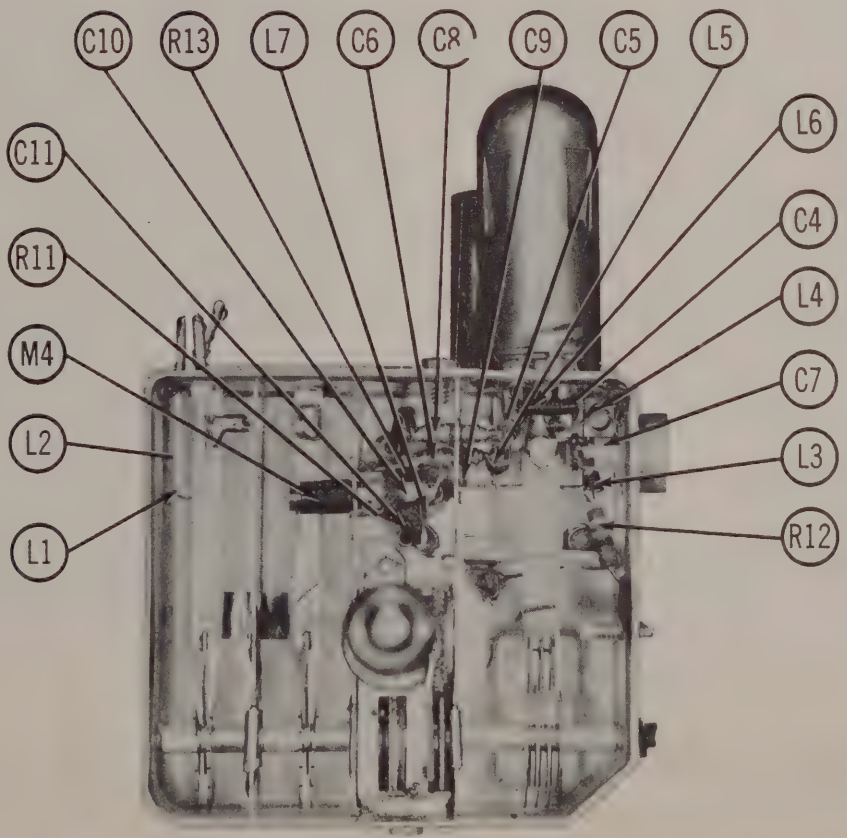


UHF-VHF TUNER TOP VIEW



UHF TUNER FRONT VIEW

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage."

INSUFFICIENT SWEEP

Check by substitution V16, V17 and V19. Check adjustments B2 and B3. Check T2, T4A, C105, R105, R106 and other associated components.

DRIVE LINES

Check by substitution V16 and V17. Check adjustment B2. Check C105, R105, T2, T4A and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V16 and V17. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines."

PIE CRUST EFFECT

Check by substitution V15, V16 and V17. Check C100 for open. Check L47, C101, C99, R100 and other associated components.

XMAS TREE EFFECT

Check by substitution V15, V16 and V17. Check T2 and T4 for internal arcing. Check L47, C101, C98, C97, R96 and other associated components.

VERTICAL

LOSS OF SWEEP

Check by substitution V13 and V14. Check waveform W9.

If Satisfactory	If Unsatisfactory
Check T3, T4B, C2D, R6 and other associated components.	Check C82, C83, C86, R9, R81, R80 and other associated components.

INSUFFICIENT SWEEP

Check by substitution V13 and V14. Check height and vertical linearity controls for proper operation. Check T3, R81 and other associated components.

COMPRESSED AT BOTTOM

Check by substitution V13 and V14. Check R9, R81, C82, C86 and other associated components.

COMPRESSED AT TOP

Check by substitution V13 and V14. Check R6, C2D, T3, T4B and other associated components.

FOLDS

Check by substitution V13 and V14. Check C84, C85, R86, R85, T3, and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Check by substitution V11 and V12. Check C79, C80, C81, R71, R73, R77, R78 and other associated components.

LOSS OF VERTICAL SYNC – HORIZONTAL SYNC SATISFACTORY

Substitute V13. Check vertical integrator network. Check C82, C83, R80, R5 and other associated components.

LOSS OF HORIZONTAL SYNC – VERTICAL SYNC SATISFACTORY

Check by substitution V12 and V15. Check C92, C93, C99, C100, L47, R99 and other associated components.

HORIZONTAL BENDING

Check by substitution V11, V12 and V15. Check horizontal AFC network.

VIDEO

LOSS OF VIDEO

Substitute V7. Check C56, C58, C59, C60, C3, R46, R47, R48, L43 and other associated components.

SOUND BARS (4.5 MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check adjustment A10. Check video IF Alignment.

POOR CONTRAST

Substitute V7. Check L40, L42, L44, C59, C60, R45 and other associated components.

NEGATIVE PICTURE

Substitute V7. Check picture tube. Check C59, C60 and other associated components.

SMEAR

Substitute V7. Check L39, L40, L42, L44, C60 and other associated components.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V2, V4, V5, V6 and V7 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V8, V9 and V10. Check stage V10 using audio signal generator. Apply audio signal across R1.

If Satisfactory	If Unsatisfactory
Check audio detector and audio IF stages for component failure or change of value.	Check C74, C75, C2C, R111, R67, R66, R68, T6, speaker and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustments R8 and A12 for minimum buzz. If still unsatisfactory, check audio IF alignment.

DISTORTED

Follow procedure outlined under "Weak or no Sound."

POWER

DEAD SET

If filaments fail to light, check AC interlock assembly. Check switch on volume control and T1. If filaments light, substitute V19. Check B+ filter and decoupling network. Check fuse, M1.

SMALL AND/OR DIM PICTURE

Substitute V19. Check B+ filter and decoupling network.

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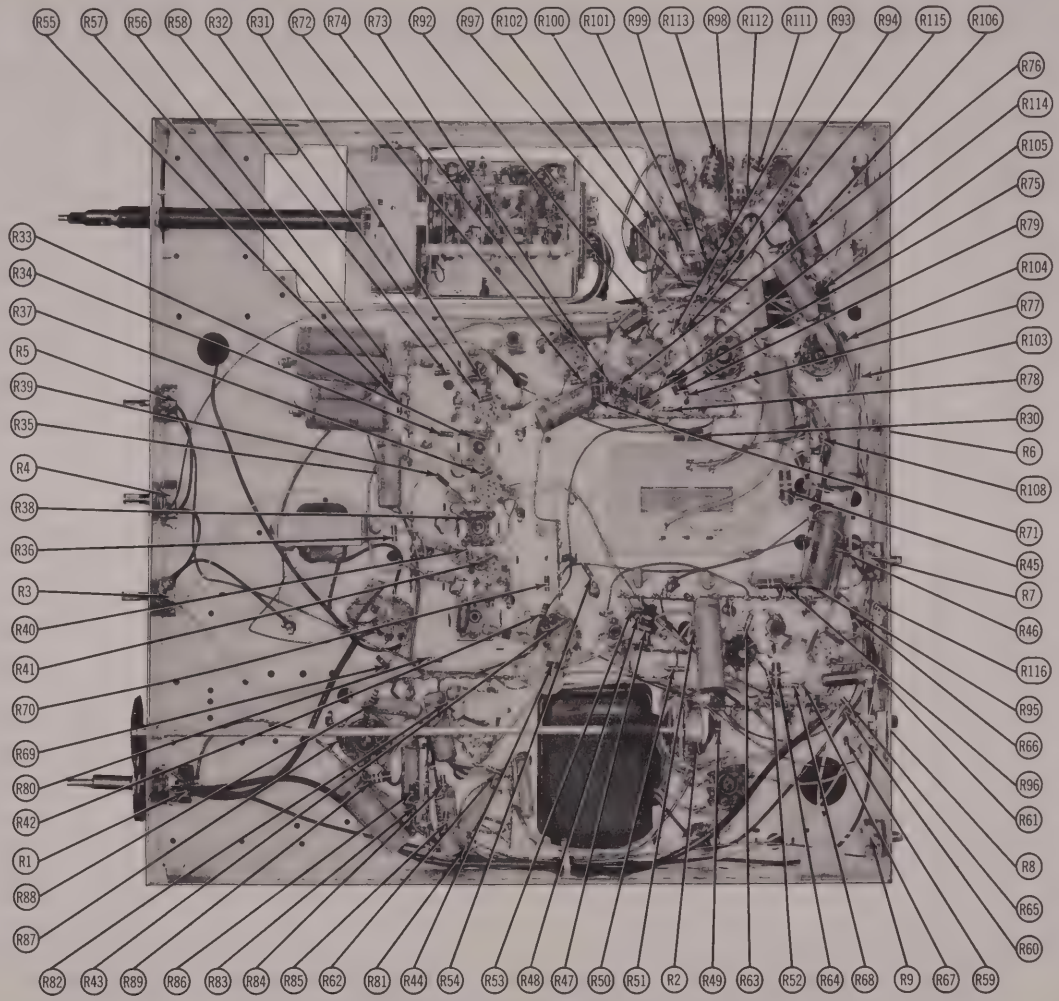
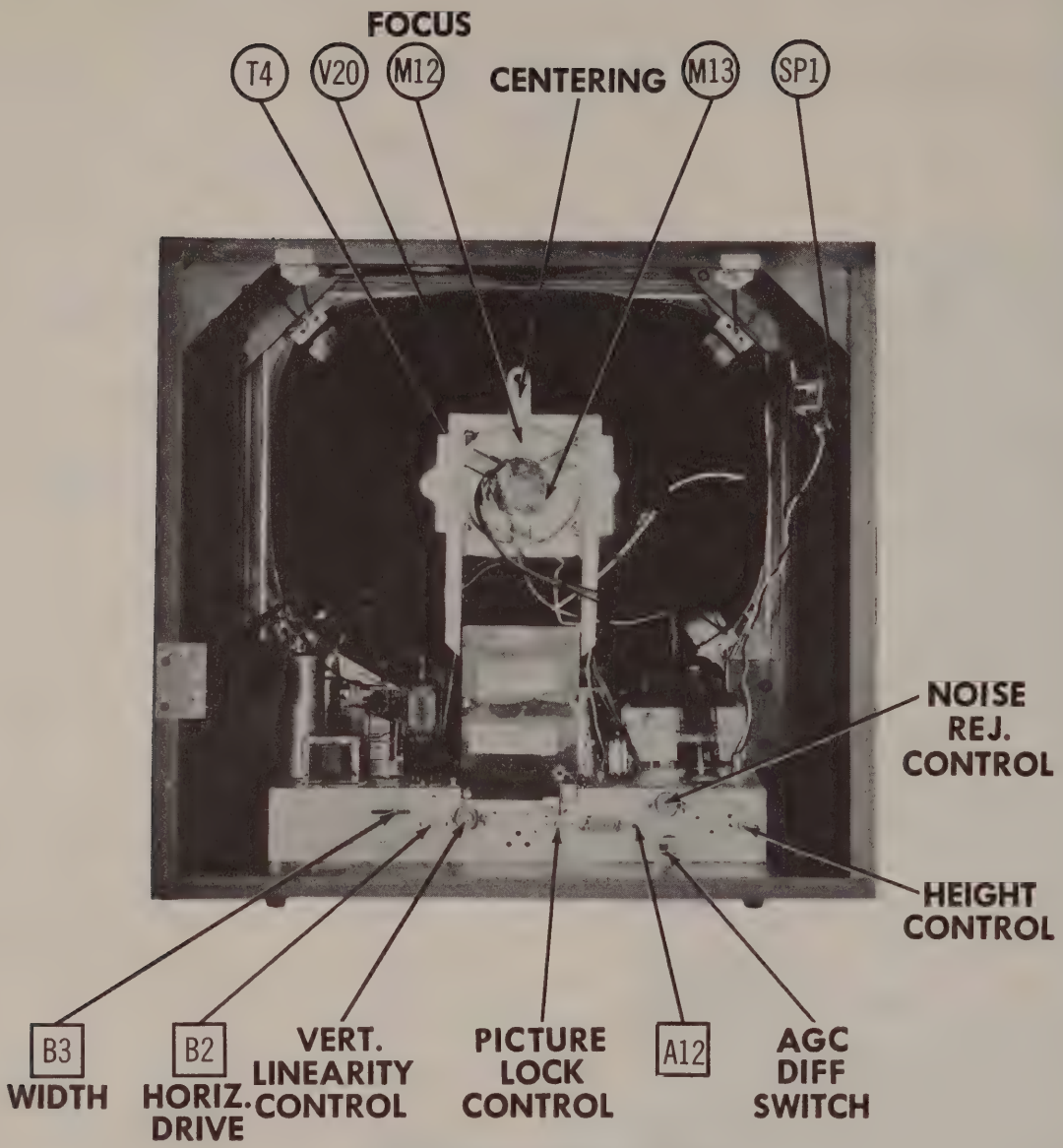
DEN[illegible]



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION



CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern.

1. Short out the horizontal oscillator coil (L47) (red and blue leads on terminal inside of HV cage).
2. Adjust the horizontal hold control (R4) until picture synchronizes horizontally. Set R4 so that approximately 1/4" is between the right edge of the raster and the right edge of the picture can be seen. Adjust the contrast control. counter clockwise and move picture off center to observe this condition.
3. Remove short from L47 and adjust the horizontal oscillator slug (B1) to again provide approximately 1/4" between the right edge of the raster and the right edge of picture.
4. Switch off channel and back again; picture should remain locked in sync. If necessary repeat steps 1 thru 4 until proper horizontal sync is obtained. Recenter picture to normal position.

Adjust the horizontal drive trimmer (B2) counter clockwise as far as possible without the presence of white vertical lines or compression near center of the picture.

Adjust the horizontal width slug (B3) for a picture slightly wider than necessary to fill the mask horizontally.

If B2 and B3 are adjusted an excessive amount, steps 1 thru 4 above should be rechecked.

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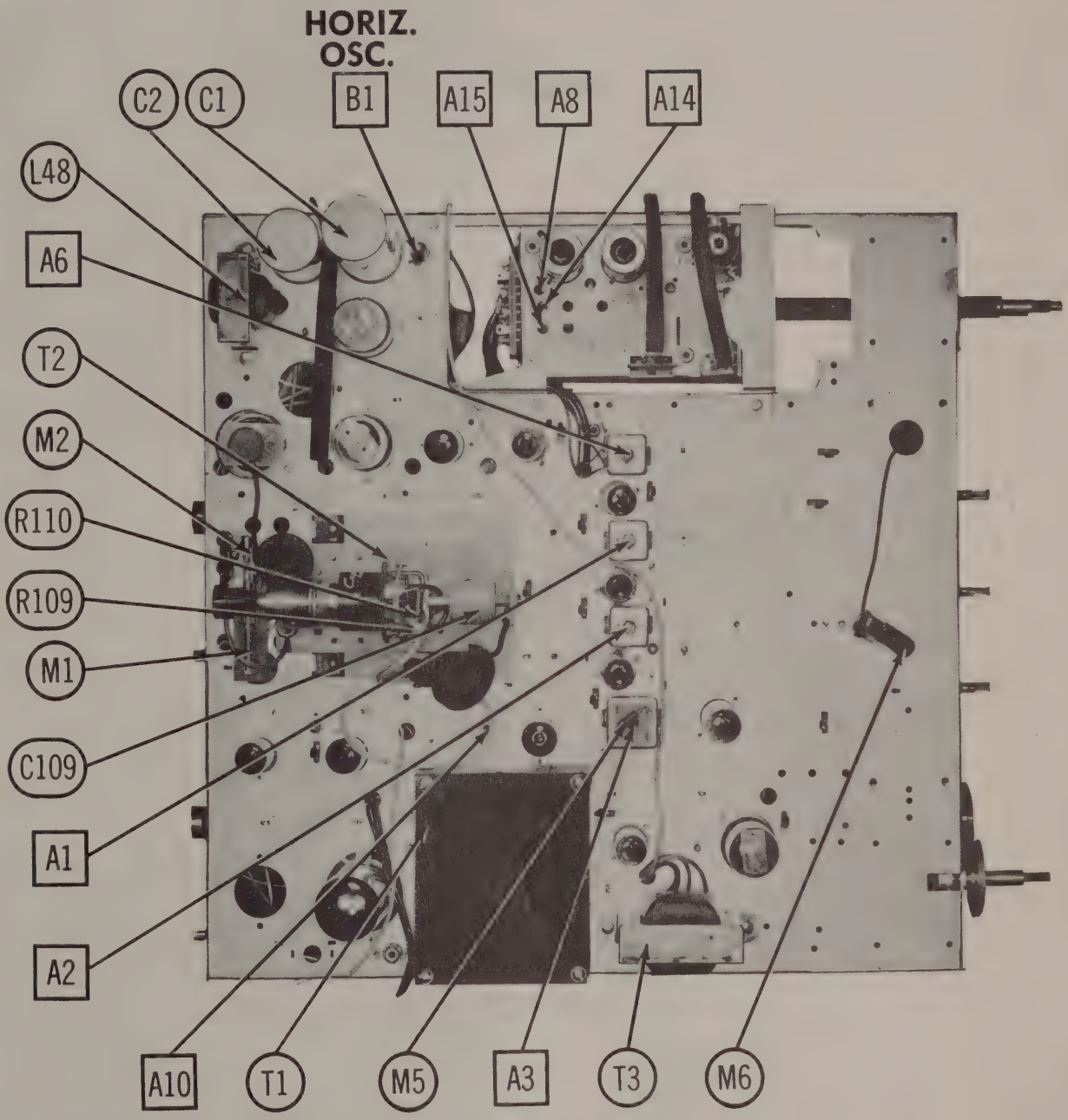
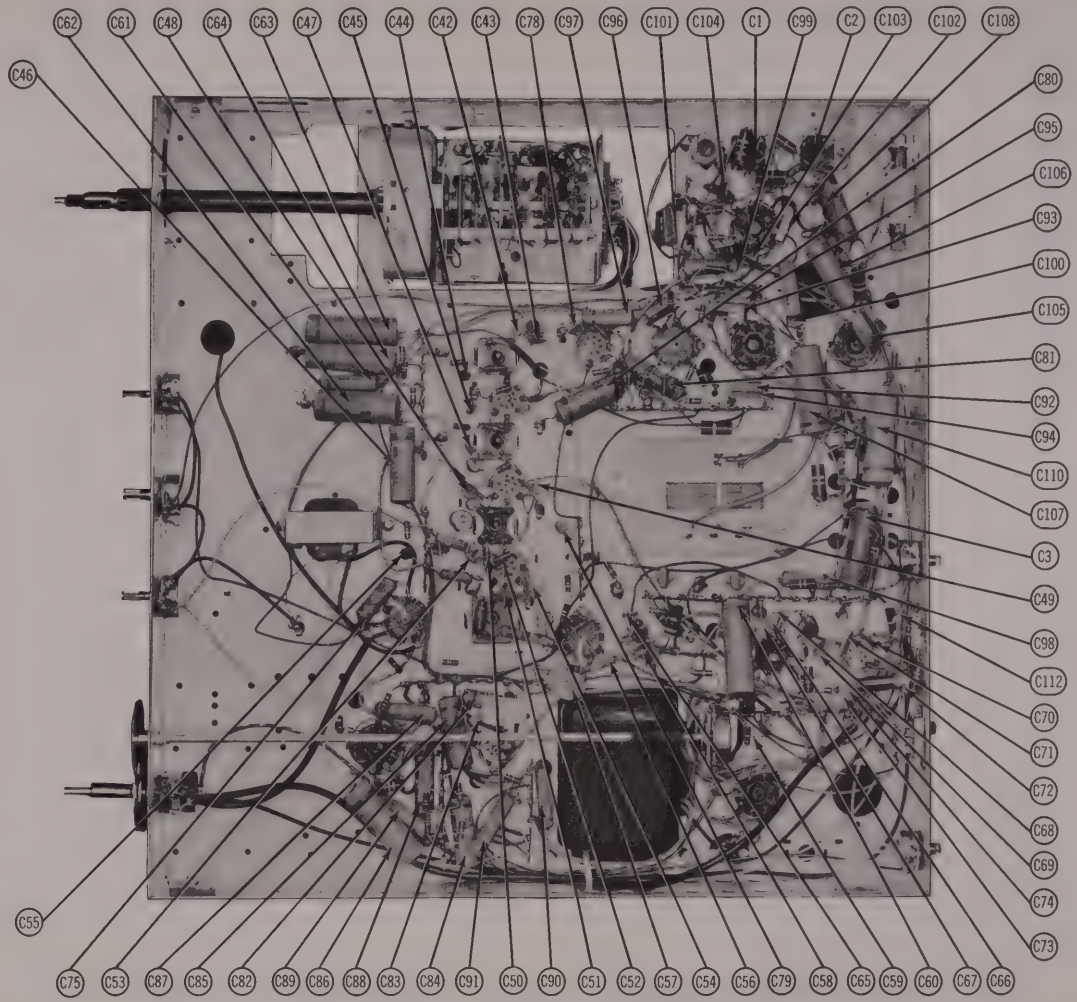
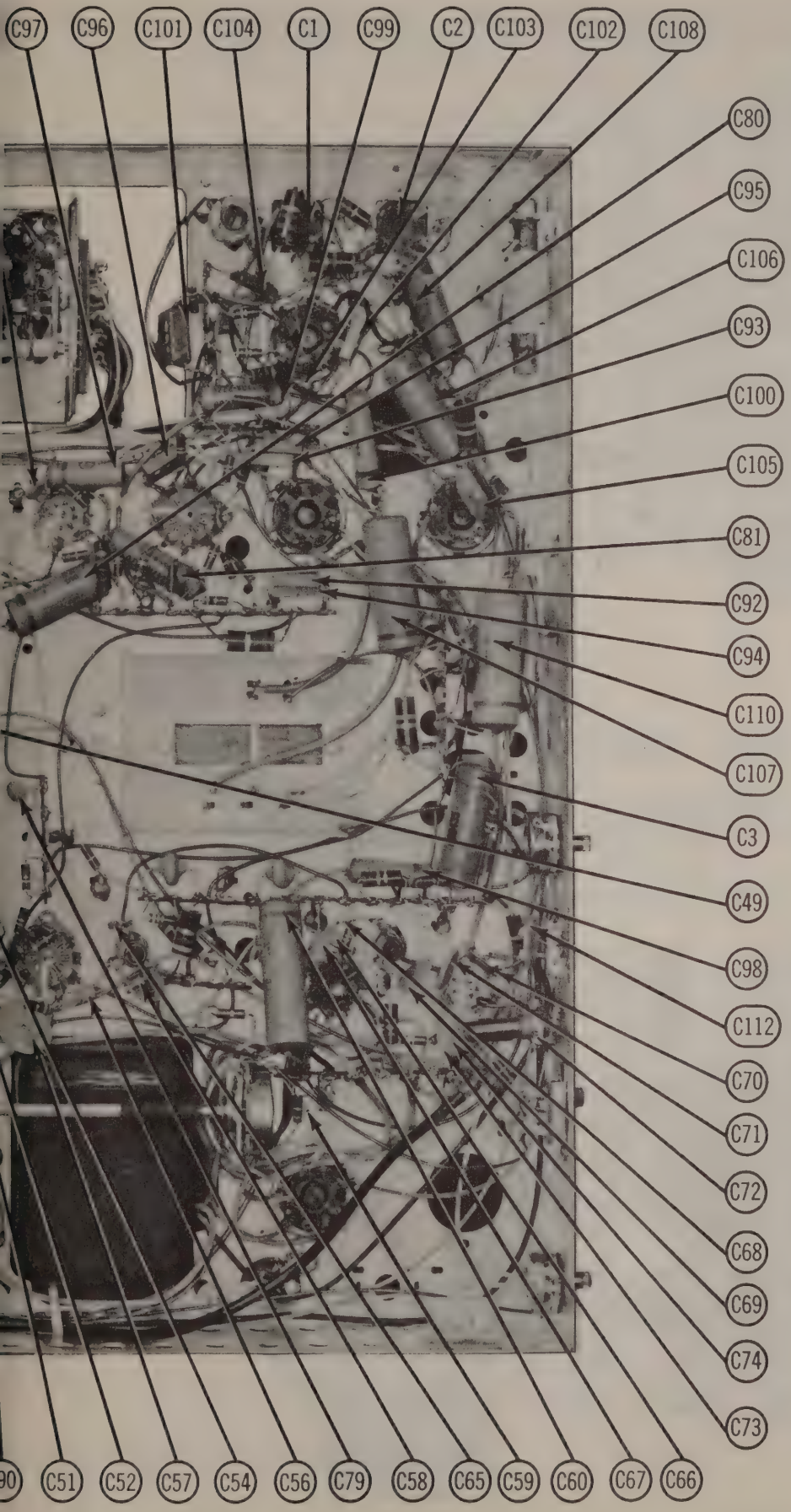


CHASSIS TOP VIEW



CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



APACITOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS (Continued)

COILS (cont)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA: CAPEHART PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L43	Shunt Peaking Coil	5.5Ω		750597A-4	19-4201	TV-184	6154	200 Microhenries
L44	Series Peaking Coil	3.6Ω		750597A-3	19-3100 ▲	TV-181 ▲	6177 ▲	100 Microhenries, wound on 2200Ω resistor Tapped @ 1Ω, .6Ω
L45	2nd. Sound IF	2.7Ω		650638B-1				
L46	Quadrature Coil	6.8Ω		650776A-1	20-1005	TV-151	1480	
L47	Horiz. Osc.	55Ω		650637B-1	19-1576	TV-163	6210	

* Use adaptor plate and drill mounting holes.
■ Drill mounting holes.
▲ Parallel with 2.2KΩ resistor.

FILTER CHOKE

ITEM No.	RATINGS: TOTAL DIRECT CURRENT	RATINGS: D. C. RESISTANCE	RATINGS: INDUCTANCE (0 CURRENT 1000 ~)	REPLACEMENT DATA: CAPEHART PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
L48	.210ADC	56Ω	1 HY	650215A-5	C5040	C-2994	C-2327	26C41	C-21X ①

① Drill one new mounting hole.

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA: CAPEHART PART No. FUSE	CAPEHART PART No. HOLDER	LITTELFUSE PART No. FUSE	LITTELFUSE PART No. HOLDER	BUSS PART No. FUSE	BUSS PART No. HOLDER
M1	3AG S/B	¼A 125V			313.500 (3AG S/B-¼A)	357001	MDL½	4405
M2	3AG S/B P/T	2/10A 125V			315.200(3AG S/B P/T 2/10A)		MDV 2/10	
M3	3/4" #26 Wire							

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA: CAPEHART PART No.	REPLACEMENT DATA: SYLVANIA PART No.	NOTES
M4	ST-47 *		1N82 or 1N82A	UHF Mixer
M5	1N64		1N60 or 1N132	Video Detector

* Some versions may use 1N82 crystal diode in this application.

MISCELLANEOUS

ITEM No.	PART NAME	CAPEHART PART No.	NOTES
M6	Dial Light		#47
M7	Tuner	850330A-1	VHF - All models
M8	Tuner	750593A-1	UHF - Used in models with suffix -5. Models with suffix -5 combine VHF tuner and UHF tuner under Part #750594A-G1
M9	Video Det. Assy.	750468D-1	Includes M5, L39, coils and capacitors.
M10	Switch	452729A-1	AGC differential
M11	Integrator	453214A-1	Vertical
M12	Focus Magnet	850291A-1	Includes centering device
M13	Ion Trap	850276A-5	
B2	Trimmer Cap.	450527B-1	Horiz. Drive (40-450MMF)
	Knob	750596B-G1	On-off-volume - Models 2T215MSD-4, 7C215MA-4, 7C215M-4, 9C215MD-4, 14F215M-4, 14F215B-4, 18C215M-4
	Knob	850891B-G1	On-off-volume - Models 2T215MSD-5, 3T215MD-5, 3T215BD-5, 7C215MA-5, 7C215M-5, 8C215MD-5, 9C215MD-5, 12F215MD-5, 14F215M-5, 14F215B-5, 18C215M-5, 1T17ES-5, 2T215BSD-5, 2T215ES-5, 7C215BA-5, 7C215B-5, 8C215BD-5, 9C215BD-5, 12F215BD-5, 18C215B-5, 3T215MD-4, 3T215BD-4, 8C215MD-4, 12F215MD-4, 8C215BD-4, 12F215BD-4
	Knob	750596B-G3	On-off-volume - Models 1T175ES-4, 2T215BSD-4, 2T215ES-4, 7C215BA-4, 7C215B-4, 9C215BD-4, 18C215B-4
	Knob	453908A-1	VHF Fine tuning - All models
	Knob	650958B-G1	VHF channel selector - Models 2T215MSD-4, 7C215MA-4, 7C215M-4, 9C215MD-4, 14F215M-4, 14F215B-4, 18C215M-4
	Knob	650955B-G1	VHF channel selector - Models 2T215MSD-5, 3T215MD-5, 3T215BD-5, 7C215MA-5, 7C215M-5, 8C215MD-5, 9C215MD-5, 12F215MD-5, 14F215M-5, 14F215B-5, 18C215M-5
	Knob	650958B-G3	VHF channel selector - Models 1T175ES-4, 2T215BSD-4, 2T215ES-4, 7C215BA-4, 7C215B-4, 9C215BD-4, 18C215B-4
	Knob	650955B-G1	VHF Channel selector - Models 1T175ES-5, 2T215BSD-5, 2T215ES-5, 7C215BA-5, 7C215B-5, 8C215BD-5, 9C215BD-5, 12F215BD-5, 18C215B-5
	Knob	650958B-G5	VHF channel selector - Models 3T215MD-4, 3T215BD-4, 8C215MD-4, 12F215MD-4, 8C215BD-4, 12F215BD-4
	Knob	750564A-1	Contrast - Models 2T215MSD-4, 7C215MA-4, 7C215M-4, 9C215MD-4, 14F215M-4, 14F215B-4, 18C215M-4
	Knob	750564A-2	Contrast- Models 2T215MSD-5, 3T215MD-5, 3T215BD-5, 7C215MA-5, 7C215M-5, 8C215MD-5, 9C215MD-5, 12F215MD-5, 14F215M-5, 14F215B-5, 18C215M-5, 1T175ES-5, 2T215BSD-5, 2T215ES-5, 7C215BA-5, 7C215B-5, 8C215BD-5, 9C215BD-5, 12F215BD-5, 18C215B-5, 3T215MD-4, 3T215BD-4, 8C215MD-4, 12F215MD-4, 8C215BD-4, 12F215BD-4
	Knob	750564A-3	Contrast - Models 1T175ES-4, 2T215BSD-4, 2T215ES-4, 7C215BA-4, 7C215B-4, 9C215BD-4, 18C215B-4
	Knob	650827A-2	Brightness, Horiz. Hold & Vert. Hold - Models 2T215MSD-4, 7C215MA-4, 7C215M-4, 9C215MD-4, 14F215M-4, 14F215B-4, 18C215M-4, 3T215MD-4, 3T215BD-4, 8C215MD-4, 12F215MD-4, 8C215BD-4, 12F215BD-4
	Knob	850827A-2	Brightness, Horiz. Hold & Vert. Hold - Models 2T215MSD-5, 3T215MD-5, 3T215BD-5, 7C215MA-5, 7C215M-5, 8C215MD-5, 9C215MD-5, 12F215MD-5, 14F215M-5, 14F215B-5, 18C215M-5,

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

PROPERTY OF
L. E. BLANKENSHIP
3634 MILAGE ST.
DENVER, COLORADO

ITEM No.	USE	REPLACEMENT DATA: CAPEHART PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	UHF Osc.	6AF4	6AF4	7DK	6T4 used as alternate
V2	HF Amp.	6BZ7	6BZ7	9AJ	
V3	Mixer - Osc.	6U8	6U8	9AE	
V4	1st. Video IF Amp.	6CB6	6CB6	7CM	
V5	2nd. Video IF Amp.	6CB6	6CB6	7CM	
V6	3rd. Video IF Amp.	6CB6	6CB6	7CM	
V7	Video Output	12BY7	12BY7	9BF	
V8	AGC Keying-Sound IF Amp.	6U8	6U8	9AE	
V9	Audio Detector	6BN6	6BN6	7DF	
V10	Audio Output	6BK5	6BK5	9BQ	
V11	Sync Separator	6CS6	6CS6	7CH	
V12	Sync Phase Inv.-Horiz. AFC	12AU7	12AU7	9A	
V13	Vert. Mult.-AGC Clamper	6BF6	6BF6	7BT	
V14	Vert. Mult-Vert. Output	6V6GT	6V6GT	7S	
V15	Horiz. Mult.	6SN7GTA	6SN7GTA	8BD	
V16	Horiz. Output	6CU6	6CU6	6AM	6BQ6GA used as alternate
V17	Damper	6W4GT	6W4GT	4CG	
V18	HV Rectifier	1B3GT	1B3GT	3C	
V19	LV Rectifier	5U4G	5U4G	5T	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA: CAPEHART PART No.	CBS PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.	RETMA BASE TYPE	NOTES
V20	21ZP4B ① 17LP4	21ZP4B ① 21ZP4A	21ZP4B ① 21ZP4A 17LP4	21ZP4B ③ 21ZP4A 21ZP4 ② 17LP4 17VP4 17LP4A ③	21ZP4B ① 21ZP4A 17LP4	12N 12N 12D 12L 12L 12L	① Aluminized ② Circuit changes necessary ③ Silver screen

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: CAPEHART PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C1A	▬50	400	750090B-42			FP317.2	TM-403020-450	Q-017	
B	20	400				TC75	TD-50-450		
C	■40	400							
D	▲30	400							
C2A	▬50	400	750090B-41			FP420.56	TM-4129	T-720	
B	■20	200						MT-0225	
C	25	25							
D	▲100	50							
C3	8	250	650228A-13			TC51	TD-8-250	FM-2508	
C4	1000			DD-102	801-001	DC-521			
C5	1000			DD-102	801-001	DC-521			
C6	1000			MFT-1000					
C7	1-4			829-4	3115-01-10	CT551			
C8	1000			MFT-1000					
C9	1			TCZ-1	NP0A-010				
C10	3.3								
C11	1000			DD-102	801-001	DC-521			
C12	1000			MFT-1000					
C13	150			DD-151	GP2K-151	UC-5315			
C14	15								
C15	5-10								
C16	5-10								
C17	18			TCZ-18	NP0K-180				
C18	15			DD-150	GP1K-150	UC-5415			
C19	6.8			TCZ-6R8	NP0A-6R8	ZT-5568			
C20	1000			DD-102	801-001	DC-521			
C21	6.8			TCZ-6R8	NP0A-6R8	ZT-5568			
C22	1000			MFT-1000					
C23	4								
C24	2.7								
C25	1000			DD-102	801-001	DC-521			
C26	1000			MFT-1000					
C27	.3								
C28	.56								
C29	.91								
C30	1000			MFT-1000					
C31	15			DD-150	GP1K-150	UC-5415			
C32	1.2								
C33	1.5			TCZ-1R5	NP0A-1R5	ZT-5515			
C34	10								
C35	10								
C36	1000			DD-102	801-001	DC-521			
C37	1000			MFT-1000					
C38	1000			DD-102	801-001	DC-521			
C39	5								
C40	1000			MFT-1000					
C41	1000			DD-102	801-001	DC-521			
C42	8.2				NP0A-8R2				
C43	22			TCZ-22	NP0K-220	ZT-5422		KR-1422	
C44	1000		450469A-5	DD-102	801-001	DC-521		K-1210	
C45	470		450469A-11	DD-471	831-471	UC-5347		K-1347	
C46	.1	400	2247-1040	DF-104		PT401	IMP4-P1	330401	
C47	1000		450469A-5	DD-102	801-001	DC-521		K-1210	
C48A	470		650858A-1	DD-471	831-471	UC-5347		K-1347	
B	470			DD-471	831-471	UC-5347		K-1347	
C49A	1000		60088IA-9	DD2-102	812-001	DCD-521		K-1210	
B	1000							K-1210	
C50	47		650030A-17	TCN-47	N750K-470	NT-5447		KR-1447	Note 1
C51	470	500	2272-21471	D6-471	GP2K-471			K-1347	
C52	470		450469A-11	DD-471	831-471	UC-5347		K-1347	
C53	470		450469A-11	DD-471	831-471	UC-5347		K-1347	

PROPERTY OF
L. F. CLARKSHIP

TROUBLE SHOOTING AIDS (cont)

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V15, V16, V17 and V18. Check fuse, M2. Check waveform W16.

If Satisfactory	If Unsatisfactory
Check T2, T4A, T5, C107, C108 C106, R106, R105 and other associated components.	Check L47, C101, C102, C103, C105, R101, R98, R99 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V16, V17 and V19. Check C103, C105, R105, T2, T4A and other associated components.

BLOOMING

Check by substitution V16, V17, V18 and V19. Check R105, R110, C105, T2 and other associated components.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video."

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or no Sound."

RASTER, NO SOUND, NO PICTURE

Check by substitution V2, V3, V4, V5, V6 and V7. Check video IF components for failure or change of value. Raster, No Sound, No Picture, UHF, substitute V1.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set."

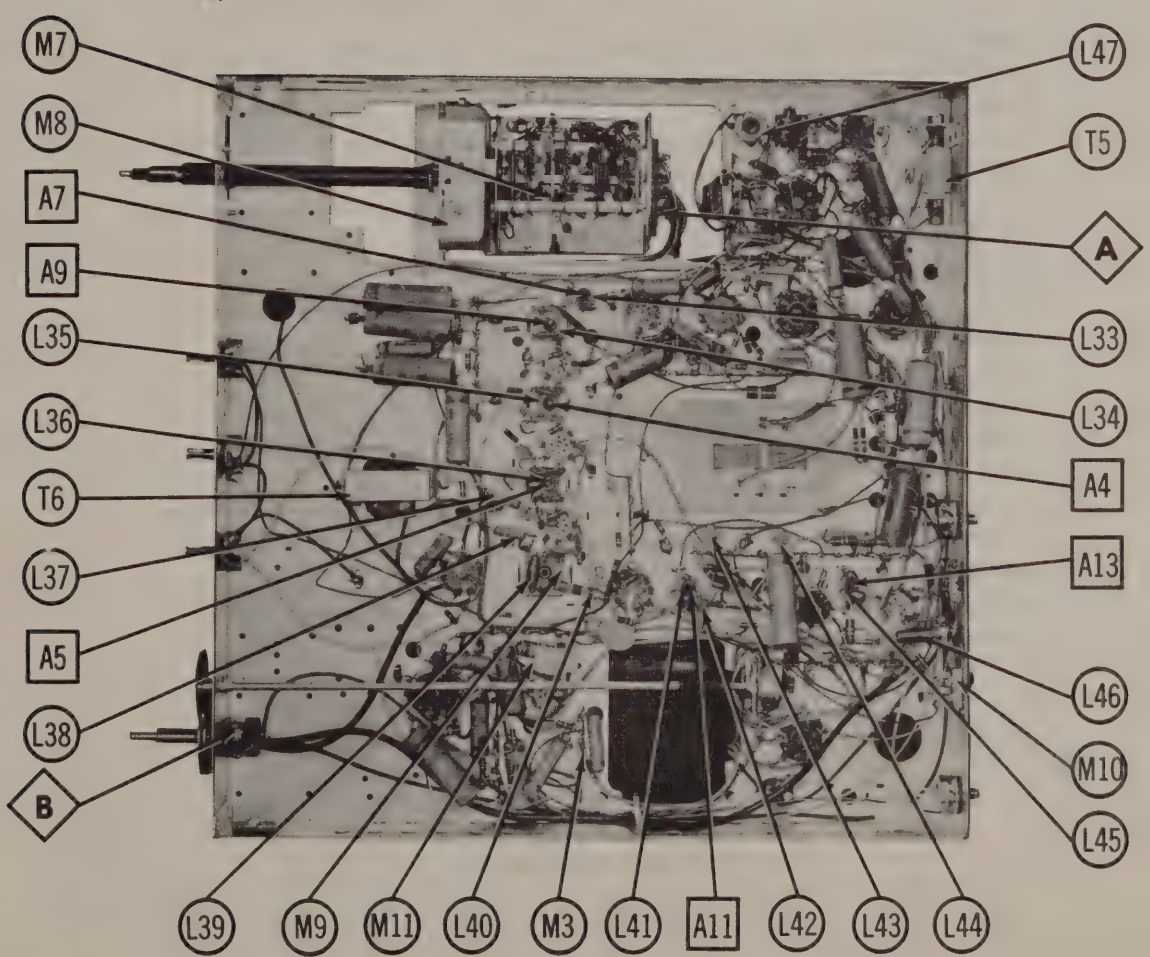
KEYSTONE EFFECT

Check T4 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



CHASSIS BOTTOM VIEW-TRANS., INDUCTOR & ALIGN. IDENTIFICATION

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

For touch-up adjustment of VHF tuner oscillator adjustments, it is necessary to remove the chassis from the cabinet. (See disassembly instructions).

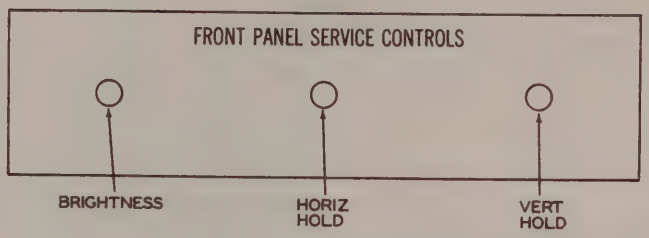
PICTURE TUBE SAFETY GLASS CLEANING

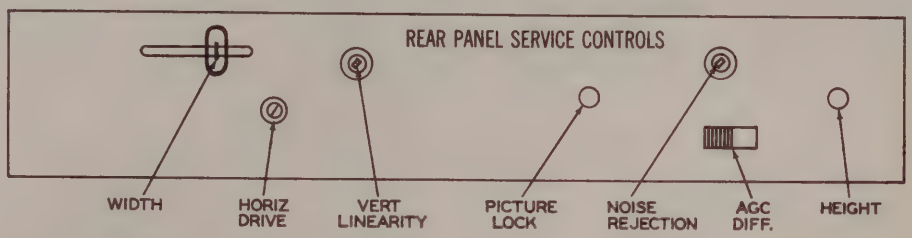
To clean safety glass remove 4 wood screws holding metal strip at the top of the safety glass. Remove metal strip and safety glass. Use extreme caution when removing safety glass.

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION





SPECIAL ADJUSTMENTS - PICTURE LOCK ADJUSTMENT

Adjustment of the picture lock control is located on the rear panel of the chassis. Tune in a TV station, preferably strongest in that area.

Rotate the picture lock control (R7) to its maximum clockwise position. While observing the picture rotate R7 slowly counter clockwise until picture starts to shift to the left. Rotate R7 back clockwise to the position just prior to the point where picture starts to shift left. In extreme noisy and weak signal areas, adjustment of R7 should be made along with other sync adjustments for stable horizontal and vertical sync.

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

Remove the rear cover and supply power to the set. Set the horizontal hold control to the center of its range and adjust the horizontal oscillator coil (L47) until the picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the noise rejection control (R8) located on rear panel of the chassis for minimum buzz and maximum volume.

FUSES

Three fuses are used. One for horizontal sweep circuit protection, one for LV power supply protection and the other for filament supply protection. (For location see tube placement chart).

CENTERING

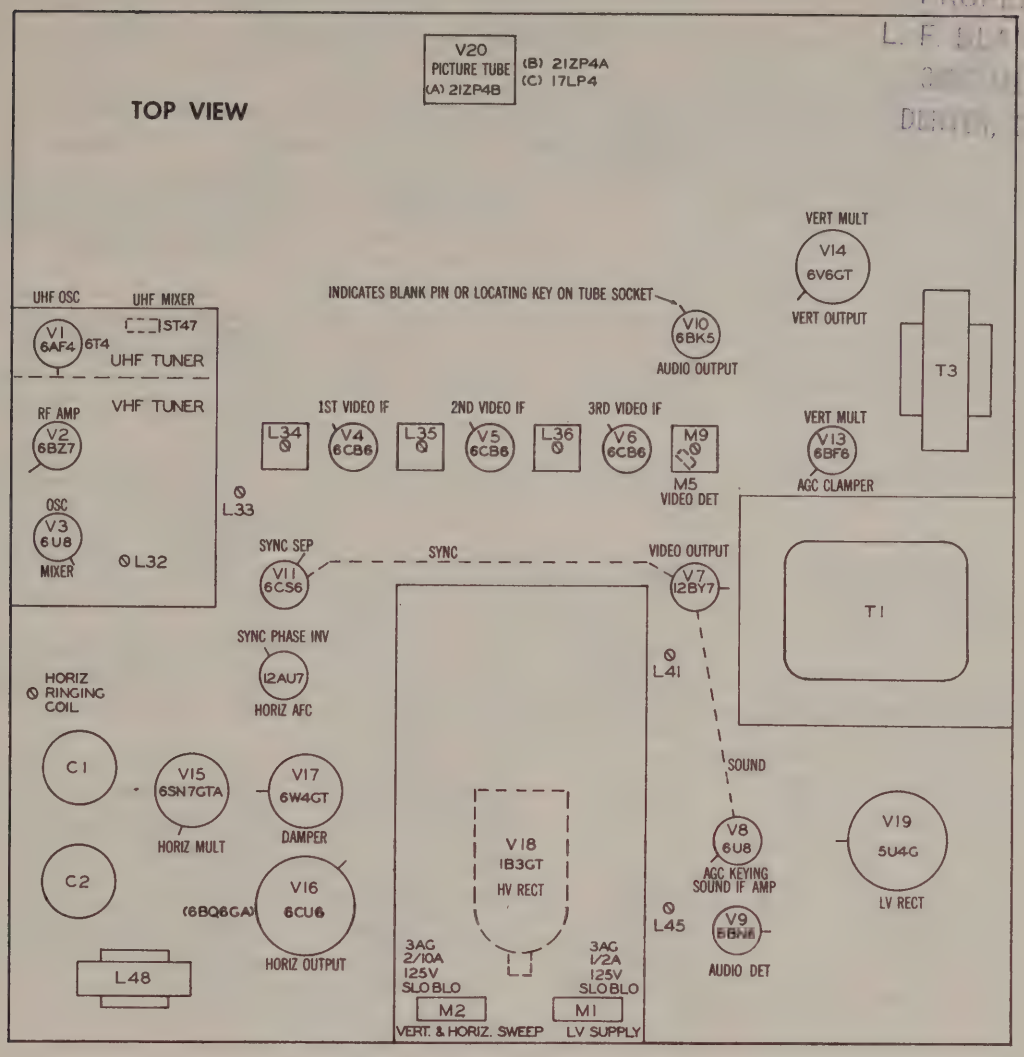
Centering is accomplished mechanically by means of a centering lever on the PM focusing assembly. Adjust the centering lever from side to side, and up and down until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

CHASSIS REMOVAL

1. Remove 4 push-on type control knobs from front panel of cabinet.
2. Remove 3 push-on type control knobs from under control door.
3. Remove 7 wood screws. Remove rear cover.
4. Disconnect speaker plug.
5. Remove 2 nuts from picture tube support rods.
6. Loosen 2 wood screws. Remove antenna bracket.
7. Remove 4 chassis bolts. Remove chassis.
8. Remove 2 speaker nuts. Remove speaker.

TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

POWER SUPPLY FAILURE
No raster, no sound - V19, Fuse (M1 & M3)

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V3, V4, V5, V6, V7 (V1 UHF only)
No pic, no sound, has snow - V2, V3, V4
No pic, has sound, has raster - V7, V8, V20
Has pic, no sound - V8, V9, V10
Overloaded picture - V8, V13

SYNC FAILURE
No vert. sync - V12, V13, V14
No horiz. sync - V12, V15
No vert. or horiz. sync - V11, V12

SWEEP FAILURE
No raster, has sound - V15, V16, V17, V18, V20, Fuse (M2)
No vertical deflection - V13, V14
Poor vert. linearity or foldover - V13, V14
Poor horiz. linearity or foldover - V15, V16, V17
Narrow picture - V15, V16, V17, V18, V19
Vert. off freq. - V12, V13, V14
Horiz. off freq. - V12, V15

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage lead should be securely taped and kept away from chassis. Do not remove the horizontal multivibrator tube (V15) to disable the high voltage.

VIDEO IF ALIGNMENT

Remove the AGC keying tube (V8A) from its socket. Connect the negative lead of a 3 volt battery to the ungrounded side of C64.
Connect positive lead to chassis.
Connect a clip lead from pin 5 of V13 to chassis.
Use high sweep generator output to make trap adjustments A1, A2 and A6 visible.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	.001MFD Capacitor	High side thru .001MFD to pin 1 (grid) of 6CB6 (V4). Low side to chassis	44MC (10MC Swp)	41.25MC	Any	Vert. Amp. thru 10KΩ to pin 2 (grid) of 12BY7 (V7). Low side to chassis.	A1	Disconnect shielded tuner lead from terminal "D" of L34. If a separate marker generator is used, couple loosely thru 10KΩ to pin 1 of V4. Adjust for MINIMUM response at marker frequency.
2.	"	"	"	47.25MC	"	"	A2	"
3.	"	"	"	44.1MC	"	"	A3	Attenuate sweep generator output for normal response on scope. Adjust A3 for maximum marker amplitude with minimum tilt.
4.	"	"	"	42.5MC	"	"	A4	Adjust A4 to position 42.5MC marker within 50% of maximum amplitude on response curve.
5.	"	"	"	45.75MC	"	"	A5	Adjust A5 to position 45.75MC marker within 50% of maximum amplitude on response curve. Repeat steps 1 thru 5. Reconnect shielded tuner lead to terminal "D" of L34.
6.	"	High side thru .001MFD to point A (on back tuner terminal). Low side to chassis.	"	47.25MC	Any non-interfering channel	"	A6	Adjust for MINIMUM response at 47.25MC marker frequency.
7.	"	"	"	39.75MC	"	"	A7	Adjust for MINIMUM response at 39.75MC marker frequency.
8.	Two 120Ω Carbon Resistors	Across VHF antenna terminal with 120Ω in each lead.	189MC (10MC Swp)	187.25MC 191.75MC	9	Vert. Amp. thru 10KΩ to pin 2 (grid) of 12BY7 (V7). Low side to chassis.		Adjust fine tuning control until sound marker falls in sound trap (Fig. 1).
9.	"	"	"	187.25MC 191.75MC	"	Vert. Amp. thru detector (Fig. 3) to pin 5 and 6 of 6CB6 (V4). Low side to chassis.	A8, A9	Connect a clip lead across pin 5 (plate) and pin 6 (screen) of V5. Adjust A8 and A9 for response curve similar to Fig. 1. Adjust for maximum amplitude and minimum tilt and to position of video marker. Remove short across pin 5 and 6 of V5.
10.	Direct	High side to an ungrounded tube shield over converter tube (V3). Low side to chassis.	44MC (10MC Swp)	39.75MC 41.25MC 42.25MC 45.75MC 47.25MC	Any non-interfering channel	Vert. Amp. thru 10KΩ to pin 2 (grid) of 12BY7 (V7). Low side to chassis.		Check for response similar to Fig. 2. If necessary, SLIGHTLY retouch A3 thru A9 for desired response. A1 and A2 should not be retouched. Remove short from pin 5 of V13. Remove bias supply. Replace V8A in its socket.

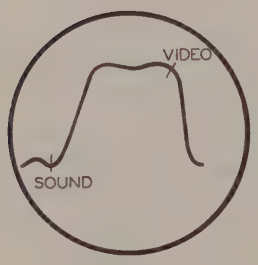


FIG.1

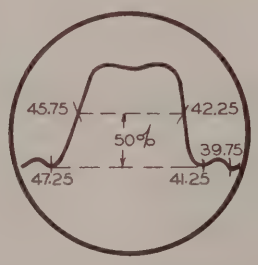


FIG.2

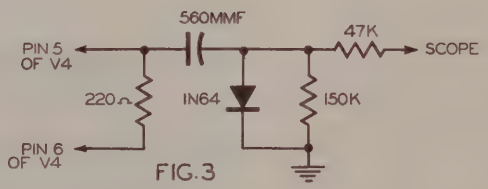


FIG.3

ALIGNMENT INSTRUCTIONS (cont)

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR, AM SIGNAL GENERATOR AND OSCILLOSCOPE

Preset the noise rejection control (R8) 90 degrees from maximum clockwise rotation.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
11.	.001MFD	High side to pin 2 (grid) of 12BY7 (V7). Low side to chassis.	Not used	4.5MC (400∿Mod)	Any	Vert. Amp. thru detector (Fig. 4) to pin 11 (cathode) of picture tube.	A10, A11	Connect a clip lead across terminals "B" and "C" of L35. Adjust A10 and A11 for MINIMUM 400∿ indication on scope.
12.	"	"	4.5MC (400∿Mod 50KC Swp)	4.5MC	"	Vert. Amp. to point (B) . Low side to chassis.	A12	Adjust for maximum 400∿ indication on scope. Two peaks will be noted when adjusting A12. Adjust for peak with maximum amplitude.
13.	"	"	"	"	"	"	A13, A11	Attenuate generator output so that signal level is below limiting level of the 6BN6 as evidenced by background hiss and noise. Adjust A13 and A-11 for maximum response on scope.
14.	"	"	Not used	4.5MC (400∿Mod)	"	"	R8	Use high signal generator output and adjust R8 for minimum 400∿ indication on scope.
15.	"	"	4.5MC (400∿Mod 50KC Swp)	4.5MC	"	"	A12	Retouch A12 for maximum 400∿ indication on scope. Use low generator output. Remove short from L35. Tune in weakest station in that area and adjust R8 for MINIMUM buzz and hiss. Tune in strongest station in that area and adjust A12 for clearest sound.

VHF OSCILLATOR ALIGNMENT

Connect bias supply as under Video IF Alignment.
Connect a clip lead from pin 5 of V13 and chassis.
Remove AGC keying tube (V8A from its socket.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
16.	Two 120Ω Carbon Resistor	Across VHF antenna terminals with 120Ω in each lead.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. Amp. thru 10KΩ to pin 2 (grid) of 12BY7 (V7). Low side to chassis.	A14	If separate marker generator is used couple it loosely across antenna terminals. Adjust to place sound marker in trap notch as in Fig. 5. Video marker should fall at 50% on high frequency slope of response curve.
17.	"	"	207MC (10MC Swp)	205.25MC 209.75MC	12	"		Check each channel for response curve similar to Fig. 5. If necessary make SLIGHT compromise adjustment of A14. SLIGHTLY rotate fine tuning control while observing response on each channel.
			201MC (10MC Swp)	199.25MC 203.75MC	11			
			195MC (10MC Swp)	193.25MC 197.75MC	10			
			189MC (10MC Swp)	187.25MC 191.75MC	9			
			183MC (10MC Swp)	181.25MC 185.75MC	8			
			177MC (10MC Swp)	175.25MC 179.75MC	7			
18.	"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A15	Check for response curve similar to Fig. 5.
19.	"	"	79MC (10MC Swp)	77.25MC 81.75MC	5	"		Check each channel for response curve similar to Fig. 5. If necessary, make compromise adjustment of A15. Replace V8A in its socket. Remove short from pin 5 of V13.
			69MC (10MC Swp)	67.25MC 71.75MC	4			
			63MC (10MC Swp)	61.25MC 65.75MC	3			
			57MC (10MC Swp)	55.25MC 59.75MC	2			

VHF RF AND MIXER ALIGNMENT

The RF and mixer portion of the VHF tuner has been properly aligned at the factory and is very stable. Alignment of this portion is not recommended in the field.

UHF TUNER ALIGNMENT

The UHF portion of this receiver has been properly aligned at the factory, and is very stable. Alignment of this portion is not recommended in the field.

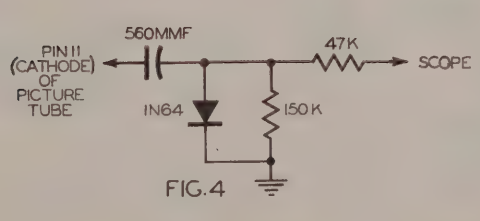


FIG.4

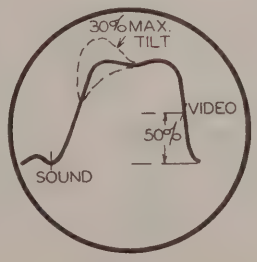


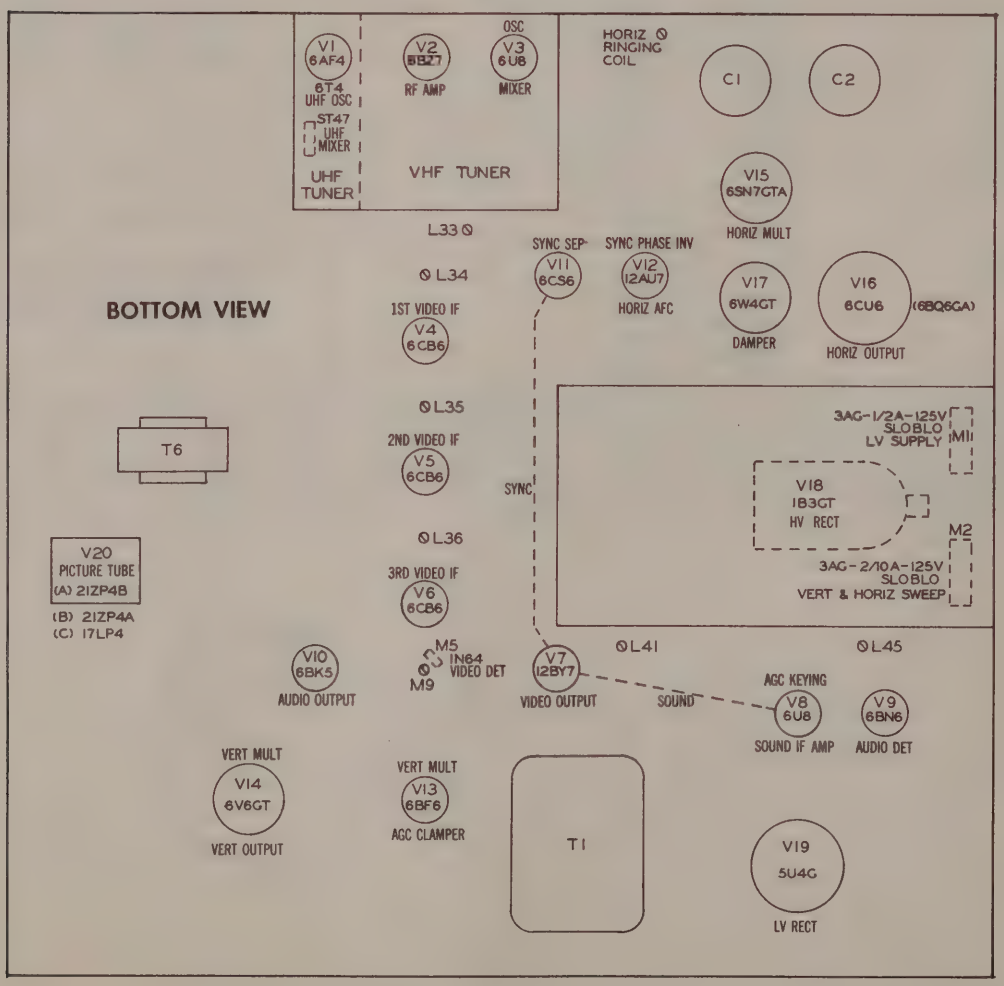
FIG.5

CAPEHART Ch. CT-109, CT-125, CT-139, CT-140, CT-157, CT-158, CT-171, CT-172 (CX-38 Series)

RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6AF4	*■4.8KΩ	10KΩ	.1Ω	0Ω	0Ω	10KΩ	*■4.8KΩ		
V 2	6BZ7	†3KΩ	500KΩ	INF	.1Ω	0Ω	INF	1Meg	0Ω	0Ω
V 3	6U8	■1.6KΩ	500KΩ	■14KΩ	.1Ω	0Ω	■100Ω	0Ω	0Ω	15KΩ
V 4	6CB6	50KΩ	47Ω	.1Ω	0Ω	▲100Ω	▲100Ω	0Ω		
V 5	6CB6	130KΩ	INF	†90KΩ	†90KΩ	†600Ω	†600Ω	INF		
V 6	6CB6	■10KΩ	■120Ω	†90KΩ	†90KΩ	†500Ω	†500Ω	70KΩ		
V 7	12BY7	39Ω	4.7KΩ	0Ω	.1Ω	.1Ω	0Ω	†5KΩ	†15KΩ	0Ω
V 8	6U8	†56KΩ	†35KΩ	▲0Ω	†90KΩ	†90KΩ	560KΩ	†500Ω	70KΩ	120KΩ
V 9	6BN6	400Ω	3.7Ω	0Ω	.1Ω	■22KΩ	6.8Ω	†330KΩ		
V 10	6BK5	†1.1KΩ	NC	200KΩ	0Ω	.1Ω	220Ω	200KΩ	†600Ω	TP
V 11	6CS6	20KΩ	0Ω	0Ω	.1Ω	■200KΩ	■22KΩ	5.6Meg		
V 12	12AU7	22KΩ	260KΩ	100KΩ	†90KΩ	†90KΩ	†14KΩ	2.2Meg	■3.9KΩ	†90KΩ
V 13	6BF6	750KΩ	0Ω	0Ω	.1Ω	800KΩ	800KΩ	†2Meg		
V 14	6V6GT	NC	.1Ω	†700Ω	†200Ω	2.2Meg	NC	0Ω	1.1KΩ	
V 15	6SN7GTA	2.3Meg	†8.3KΩ	1.2KΩ	100KΩ	†120KΩ	1.2KΩ	.1Ω	0Ω	
V 16	6CU6	NC	.1Ω	TP	†12KΩ	1Meg	NC	0Ω	0Ω	TOP CAP ▲24Ω
V 17	6W4GT	NC	NC	INF	NC	†250Ω	NC	†90KΩ	†90KΩ	
V 18	1B3GT		PINS	1 - 8	HAVE	INF	RESISTANCE			TOP CAP ▲384Ω
V 19	5U4G	NC	60KΩ	NC	16Ω	NC	18Ω	TP	60KΩ	
V 20	21ZP4B	0Ω	35KΩ	PIN 10 ▲0Ω	PIN 11 ■330KΩ	PIN 12 .1Ω				

* MEASURED IN "UHF" POSITION
■ MEASURED FROM 135V LINE
† MEASURED FROM PIN 8 OF V19
▲ MEASURED FROM PIN 7 OF V5
TP - TIE POINT
NC - NO CONNECTION
▲ MEASURED FROM PIN 3 OF V17



TUBE PLACEMENT CHART

CAPACITORS (cont)

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA CAPEHART PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	FYRAMID PART No.	SANGAMO PART No.	NOTES
C54A	1000		600881A-8	DDS-102	812-001	DCD-521		K-1210	
B	1000							K-1210	
C55	1000		450469A-5	DD-521	801-001	DC-521		K-1210	
C56	1000		450469A-5	DD-521	801-001	DC-521		K-1210	
C57	5000		450465A-12	DD-523	811-006	DC-525		K-1215	
C58	47		650030A-17	TCN-47	N750K-470	NT-5447			
C59	47		650030A-17	TCN-47	N750K-470	NT-5447		KR-1447	
C60	.1	600	2348-1040	DF-104		DF501	IMPE-P1	330601	
C61	.01	300	2348-3330	DS-103	GP3-333-103	DF741	IMPE-S1	330411	
C62	.22	400	2347-2340			PT4023	IMP4-P22	3304022	
C63	.22	400	2347-2340			PT4023	IMP4-P22	3304022	
C64	.33	300	2346-2340			PT4033	IMP3-P33	3302022	
C65	3.3		650030A-0	TCS-3R3	NPOA-3R3	XT-5533			
C66	47		650030A-17	TCN-47	N750K-470	NT-5447		KR-1447	
C67	10000		600881A-8	DD-103	811-01	DC-51			
C68	3.3		6500030A-5	TCS-3R3	NPOA-3R3	XT-5533			
C69	10000		600881A-8	DD-103	811-01	DC-51			
C70	10000		600881A-8	DD-103	811-01	DC-511			
C71	10000		600881A-8	DD-103	811-01	DC-511			
C72	10		650030A-10	TCA-10					
C73	1000		600842A-7	DD-103	801-001	DC-521	IMPE-D1	K-1210	
C74	10000		600881A-8	DD-103	811-01	DC-511	IMPE-S1	330611	
C75	.01	400	2347-1030	DS-103	GP3-333-103	PT411	IMP4-S1	330411	Note 2
C76	.022	400		DF-303	817-02	PT4123	IMP4-S23	3304123	Note 2
C77	.0033	600		DS-333	GP3-333-333	PT6333	IMP6-D33	3306333	Note 3
C78	27		2371-0023	TCS-27	NPOL-270			KR-1427	
C79	1500		600881A-5	DD-153	811-0015	DC-5215	IMP6-D15	C-1215	
C80	.1	400	2347-1040	DF-104		PT401	IMP4-P1	330401	
C81	.047	400	2347-4730	DF-503		PT4147	IMP4-S47	3304147	
C82	.001	600	2348-1030	DS-102	GP3L-102	PT621	IMP6-D1	330621	
C83	390	500	2372-2391	DS-391		MC3243		KR-1239	
C84	.033	600	2348-3330	DF-303		PT6133	IMP6-S3	3306133	
C85	.068	200	2346-6839						
C86	.1	600	2348-1040	DF-104		PT601	IMP6-P1	330601	
C87	.01	300	2346-1030	DS-103	GP3-333-103	PT411	IMP4-S1	330411	
C88	.0027	1000	2349-2729						
C89	.033	400	2347-3330	DF-303	817-02	PT4123	IMP4-S23	3304122	
C90	.022	300	2346-2330	DF-303	817-02	PT4123	IMP4-S23	3304122	
C91	.033	500	2346-3330	DF-303	817-02	PT4123	IMP4-S23	3304122	
C92	470	500	2372-2147L	D6-471	GP2K-471	MC345		K-1347	
C93	470	500	2372-2147L	D6-471	GP2K-471	MC345		K-1347	
C94	470	500	2372-2147L	D6-471	GP2K-471	MC345		K-1347	
C95	270	500	2372-2127L	D6-271	GP2K-271	MC341		K-1327	
C96	47	500	2372-2147D	D6-470	GP2K-470	MC3205		K-1447	
C97	.0022	600	2348-2230	DF-223	GP3-333-222	PT6223	IMP6-D23	3306223	
C98	.001	600	2348-1030	D6-102	GP2L-102	PT621	IMP6-D1	330621	
C99	.0023	500	2348-2330	D6-232	GP3-333-222	PT6223	IMP6-D47	3306247	
C100	.022	300	2346-2230	DF-303	817-02	PT4122	IMP4-S23	3304122	
C101	4700	500	2372-4347Z			MC3465		CR-1247	
C102	100	500	2372-2101L	D6-101	MPG-337-101	MC3231		K-1310	
C103	390	500	2372-2339L	D6-391		MC3243		KR-1239	
C104	330	500	2372-2331L	D6-331				KR-1233	
C105	470	500	2372-2147L	D6-471	GP2K-471	MC345		K-1347	
C106	.047	600	2348-4730	DF-503		PT6147	IMP6-S47	3306147	
C107	.33	400	2347-3340			PT4033	IMP4-P33	3304033	
C108	.1	300	2346-1040	DF-104		PT401	IMP3-P1	330301	
C109	500	20000	650153D-2	TV3-502	413	TV20035A			
C110	.22	400	2347-2340			PT4023	IMP4-P23	3304022	
C111	56	3000		DD30-560	3KV-560	DC30456			
C112A	1500	1000	453521A-4	DD-152	BR5KV-152	DC30215			
B	1500	1000		DD-152	BR5KV-152	DC30215			

Note 1. Not used in chassis coded CX38H-1.
Note 2. Not used when tone control R10 is installed.
Note 3. Not used when tone control R10 is removed.

CONTROLS

ITEM No.	RATING RESIST-ANCE	RATING WATTS	REPLACEMENT DATA CAPEHART PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1	500KΩ	½	650928A-1					Volume & switch
R2A	15KΩ	½	650937A-1	QHT-15EX		ABT-154		Contrast - tapped ④ 7ΣΩ
B	Shaft		Not Req.	NQ		AK-3		Attach to R2A
R3A	300KΩ	½	453328A-3	QH-129	A47-300K-S	AB-48	U-43	Brightness
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R3A
R4A	100KΩ	½	453325A-2	QH-126	A47-100K-S	AB-40	U-41	Horiz. Hold
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R4A
R5A	1Meg	½	453466A-1	QH-137	A47-1Meg-S	AB-49	U-54	Vert. Hold
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R5A
R6	3000Ω with 700Ω stop	1	650842A-3	WK-2500	39-3000-700		R2500L	Vert. Linearity - wire-wound Note 1
R7A	2.5Meg	½	650775A-1	QH-239	A47-2.5Meg-S	HK-23	SU-565	Picture Lock
B	Shaft		Not Req.	Not Req.	FKH-1/4	Not Req.	Not Req.	Attach to R7A
R8	500Ω	½	650842A-5	W-500	39-500			Noise rejection - wire-wound
R8A	2.5Meg	½	650775A-1	QH-239	A47-2.5Meg-S	HK-23	SU-565	Height
B	Shaft		Not Req.	Not Req.	FKH-1/4	Not Req.	Not Req.	Attach to R8A
R10	50KΩ	½						Tone - Note 2

Note 1. Add a 680Ω resistor in series with the lead and the terminal of control (omit 680Ω resistor in Claronal's replacement).
Note 2. Not used in all versions.

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA CAPEHART PART No	IRC PART No.	NOTES
R11	270Ω	1		BTS-270	
R12	10KΩ	1		BTS-10K	
R13	100Ω	1		BTS-100	
R14	56Ω	1		BTS-56	
R15	100KΩ	1		BTS-100K	
R16	1Meg 5%	1		BTS-1Meg 5%	
R17	750KΩ 5%	1		BTS-750K 5%	
R18	470Ω	1		BTS-470	
R19	6800Ω	1		BTS-6800	
R20	10KΩ	1		BTS-10K	
R21	470KΩ	1		BTS-470K	
R22	10KΩ	1		BTS-10K	
R23	10KΩ	1		BTS-10K	
R24	100Ω	1		BTS-100	
R25	15KΩ	1		BTS-15K	
R26	220KΩ	1		BTS-220K	
R27	2200Ω	1		BTA-2200	
R28	1500Ω	1		BTB-1500	
R29	150KΩ	1		BTS-150K	
R30	2200Ω	2	3336-322	BTB-2200	
R31	1300Ω	2		BTB-1300	Note 1
R32	470 5%	2	3329-470	BTH-47 5%	
R33	22KΩ	2	3329-223	BTB-22K	
R34	100Ω	2	3330-101	BTB-100	
R35	220KΩ 5%	2	3328-224	BTB-220K 5%	
R36	220KΩ 5%	2	3328-224	BTB-220K 5%	
R37	47Ω	2	3329-470	BTB-47	
R38	22KΩ	2	3329-223	BTB-22K	
R39	100Ω	2	3330-101	BTB-100	
R40	10KΩ	2	3329-103	BTB-10K	Note 2
R41	120Ω	2	3329-121	BTB-120	
R42	150K 5%	2	3328-153	BTB-150K 5%	
R43	4700Ω	2	3329-472	BTB-4700	
R44	39Ω	2	3329-390	BTB-39	
R45	15KΩ	2	3335-153	BTB-15K	Note 3
R46	3900Ω	2	3335-392	BTB-3900	Note 3
R47	3300Ω	2	3335-332	BTB-3300	
R48	3300Ω	2	3335-332	BTB-3300	
R49	270KΩ	2	3329-273	BTB-2700	
R50	3200Ω	2	3329-323	BTB-3200	
R51	330KΩ	2	3328-334	BTB-330K	
R52	100KΩ	2	3329-104	BTB-100K	
R53	39KΩ	2	3329-393	BTB-39K	
R54	10KΩ	2	3329-103	BTB-10K	
R55	10KΩ	2	3329-103	BTB-10K	
R56	470KΩ	2	3329-474	BTB-470K	
R57	560KΩ	2	3329-564	BTB-560K	
R58	1000Ω	2	3330-102	BTB-1000	
R59	24KΩ 5%	2	3328-243	BTB-24K 5%	
R60	15KΩ 5%	2	3328-153	BTB-15K 5%	
R61	27KΩ 5%	2	3328-273	BTB-27K 5%	
R62	2.7Meg	2	3329-278	BTB-2.7Meg	
R63	56KΩ	2	3329-563	BTB-56K	
R64	56KΩ	1	3322-563	BTA-56K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA CAPEHART PART No	IRC PART No.	NOTES
R65	150Ω	½	3329-151	BTS-150	
R66	22KΩ	1	3322-223	BTA-22K	
R67	680Ω	½	3329-681	BTS-680	
R68	330KΩ	½	3329-334	BTS-330	
R69	220Ω	½	3329-221	BTS-220	
R70	470KΩ	½	3329-474	BTS-470K	
R71	22KΩ	1	3322-223	BTA-22K	
R72	5.6Meg	½	3329-565	BTS-5.6Meg	
R73	560KΩ	½	3329-564	BTS-560K	
R74	220KΩ	½	3329-224	BTS-220K	
R75	2.2Meg	½	3329-225	BTS-2.2Meg	
R76	3900Ω	½	3329-392	BTS-3900	
R77	10KΩ	½	3329-103	BTS-10K	
R78	3900Ω	½	3329-392	BTS-3900	
R79	22KΩ	½	3329-223	BTS-22K	
R80	470KΩ	½	3329-474	BTS-470K	
R81	820KΩ	½	3329-824	BTS-820K	
R82	100KΩ	½	3329-104	BTS-100K	
R83	56KΩ	½	3329-563	BTS-56K	
R84	12KΩ	½	3329-123	BTS-12K	
R85	120KΩ	2	3329-124	BTB-120K	
R86	10KΩ	2	3329-103	BTS-10K	
R87	2.2Meg	2	3329-225	BTS-2.2Meg	
R88	33KΩ	2	3329-333	BTB-33K	
R89	56KΩ	1	3322-563	BTA-56K	
R90	560Ω	2		BTB-560	
R91	560Ω	2		BTB-560	
R92	82KΩ	2	3329-823	BTB-82K	
R93	82KΩ	2	3329-823	BTB-82K	
R94	100KΩ	2	3329-104	BTB-100K	
R95	33KΩ	2	3329-333	BTB-33K	
R96	82KΩ	1	3322-823	BTA-82K	
R97	2.2Meg	2	3329-225	BTB-2.2Meg	
R98	120KΩ	2	3329-123	BTB-120K	
R99	8200Ω	1	3322-822	BTA-8200	
R100	47KΩ	2		BTB-47K	
R101	120KΩ	2	3329-124	BTB-120K	
R102	10KΩ	2	3329-103	BTB-10K	
R103	1Meg	2	3329-105	BTB-1Meg	
R104	47Ω	2	3329-470	BTB-47	
R105	12KΩ	2	3335-123	BTB-12K	
R106	180Ω	4	650101A-35		
R107	2200Ω	2		BTB-2200	
R108	470Ω	1	3330-471	BTS-470	
R109	6.8Ω	2	650101A-23		
R110	1Meg	1	45347TA-1	BTA-1Meg	
R111	470Ω	1	3322-471	BTA-470	
R112	150Ω	2	3335-151		
R113	270Ω	2	3335-271		
R114	100KΩ	1	3329-104	BTS-100K	
R115	180KΩ	1	3329-184	BTS-180K	
R116	330KΩ	1	3329-334	BTS-330K	
R117	33KΩ	1	3322-333	BTA-33K	Note 4
R118	33KΩ	2	3335-333	BTB-33K	Note 4

Note 1. Some versions use a 3300Ω resistor in this application.
Note 2. Not used in chassis coded CX-38H-1.
Note 3. Used in chassis CX-38H-2.
Note 4. Used in chassis CX-38H-1.

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	REPLACEMENT DATA CAPEHART PART No.	Halldorson PART No.	Merit PART No.	RCA TYPE No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @1.62A	600VCT .210ADC	5VAC ② 3A	850300B-3		P-3055		P-8331		
		SEC. 3	SEC. 4 SEC. 5							
		6.3VAC @2.55A	6.3VAC ② 7A							

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	REPLACEMENT DATA CAPEHART PART No.	Halldorson PART No.	Merit PART No.	RCA PART No.	Ram PART No	Stancor TYPE No	Thordarson PART No.	Triad PART No
T2	Horiz. Output Trans.	850325F-1				X099 *			
		850285D-1①							
T3	Vert. Output Trans.	750354C-2	21802	A-3038	20472 ②	V305	A-8142	28853	A-92X
T4A	Yoke-Horiz.(64MH)	850231C-2	DF803 ③	MDF-72 ②	21JD2 ②	Y70714, 43 ③	DY-9A ④	Y-7 ②	Y-7-1 ②
B	Vert.(39MH)								
T5A	Width Coil (12-1.2MH	650589B-1						WC-20	
B	AGC Winding (7.5-30MH)								

① Alternate horizontal output transformer.
② Drill new mounting hole(s).
③ Connect horizontal damping network across terminals #1 and #2, use original network if necessary.
④ Remove damping capacitor from terminals #3 and #7. Use original horizontal network if necessary.

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

ORIGINAL TERMINAL (CONNECTION)	Halldorson Replacement Connections	Merit Replacement Connections	RCA Replacement Connections	Ram Replacement Connections	Stancor Replacement Connections	Thordarson Replacement Connections	Triad Replacement Connections
3				3			
2				2			
1				1			
7							
4				4			
5				5			
6				6			
Connect Width Coil Across	5 & 6			5 & 6			

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA CAPEHART PART No.	Halldorson PART No.	Merit PART No	Stancor PART No	Thordarson PART No	Triad PART No	NOTES
T6	8KΩ	3.7Ω	650218A-3	21002	A-3020	A-3849	26848	S-82	

SPEAKER

ITEM No.	RATINGS SIZE	FIELD	V C IMP	REPLACEMENT DATA CAPEHART PART No.	QUAM PART No.	NOTES
SP1	4"	PM	3.7Ω	750457A-2	4A1	

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA CAPEHART PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	VHF Ant. Coupling Coil	0Ω						
L2	VHF Ant. Grid Coil	0Ω						
L3	330µH RF Coil	0Ω						
L4	Fil. Choke	0Ω						
L5	Fil. Choke	0Ω						
L6	Cathode Choke	0Ω						
L7	UHF IF Coil	0Ω						
L8	VHF Ant. Coupling Coil	.8Ω	.5Ω					
L9	VHF Ant. Coupling Coil	.8Ω						
L10	IF Trap	.2Ω						
L11	Trap Coil	0Ω						
L12	IF Trap	.2Ω						
L13	UHF Ant. Coil	1.6Ω						
L14	VHF Ant. Coils	0Ω						
L15	VHF Ant. Coil	0Ω						Channel 13
L16	UHF IF Coil	0Ω						
L17	Fil. Choke	0Ω						
L18	Neut. Coil	0Ω						
L19	VHF RF Coil	0Ω						Channel 13
L20	VHF RF Coils	0Ω						
L21	UHF IF Coil	0Ω						
L22	VHF Mixer, Grid Coil	0Ω						Channel 13
L23	VHF Mixer Grid Coils	0Ω						
L24	UHF IF Coil	0Ω						
L25	RF Coil	0Ω						
L26	Fil. Choke	0Ω						
L27	VHF Osc. Coils	0Ω						
L28	VHF Osc. Coil	0Ω						Channel 6
L29	VHF Osc. Coil	0Ω						Channel 13
L30	RF Coil	1.4Ω						
L31	Feedback Coil	0Ω						
L32	Conv. Plate	.1Ω	0Ω					
L33	39.75MC Trap	0Ω		650946A-1			6225	
L34	Int. Video IF	.1Ω		750460C-1		17-5003 *	TV-128 *	6233 *	Includes 47.25MC trap
L35	2nd. Video IF	.1Ω	.2Ω	750461D-1		17-5003 *	TV-127 *	6233 *	Includes 41.25MC trap
L36	3rd. Video IF	.1Ω	.1Ω	750461D-1		17-4521 *	TV-126 *	6233 *	Includes 47.25MC trap
L37	RF Choke	1.8Ω		450358A-4		19-1003		6806	2.2 Microhenries, IRC part #CLA
L38	RF Choke	1.8Ω		450358A-6		19-1003		6806	2.2 Microhenries, IRC part #CLA
L39	Series Peaking Coil	1Ω		750597A-1		19-3160	TV-194	6180	180 Microhenries
L40	Series Peaking Coil	8.2Ω		450358A-5		19-1005		6812	10 Microhenries, IRC part #CL-1
L41A	4.5MC Trap	1.9Ω							
B	Sound IF	3.1Ω		850929A-1					
L42	Series Peaking Coil	4.4Ω		750597A-2		19-3135		6183	140 Microhenries wound on 5600Ω resistor

CAPEHART Ch. CT-109, CT-125, CT-139, CT-140, CT-157, CT-158, CT-171, CT-172 (CX-38 Series)

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

ESPEY
MODEL 201

ESPEY
MODEL 201

TRADE NAME	Espey Model 201		
MANUFACTURER	Espey Mfg. Co., Inc., 528 E. 72nd. St., New York 21, N.Y.		
TYPE SET	AC Operated AM-FM Superheterodyne Receiver For Custom Installation		
TUBES	Fifteen		
POWER SUPPLY	105-125 Volts AC-50/60 Cycles	RATING	.92 Amp. @ 117 Volts AC
TUNING RANGE-BROADCAST	535KC-1720KC	FREQ. MOD.	88MC-108MC

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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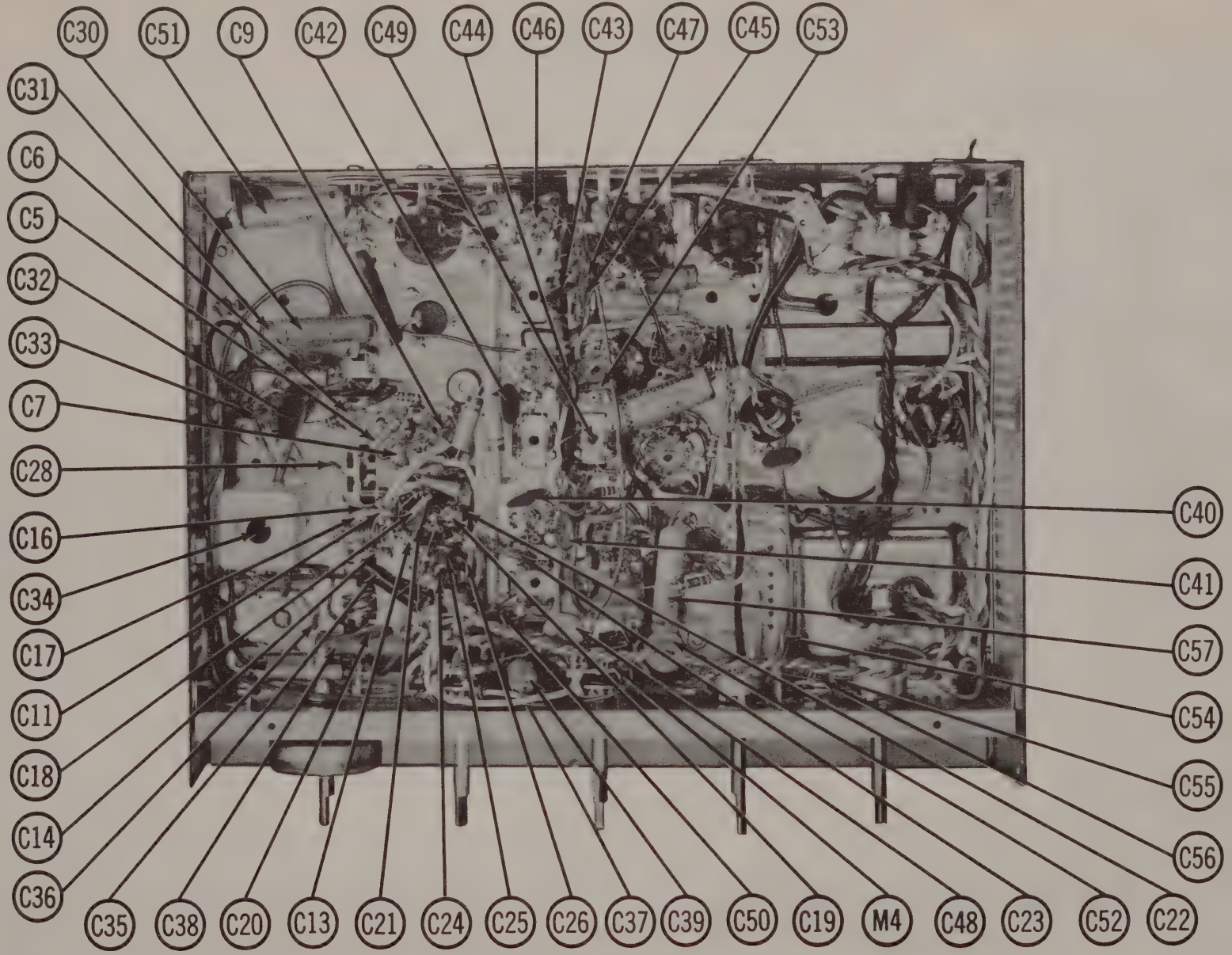
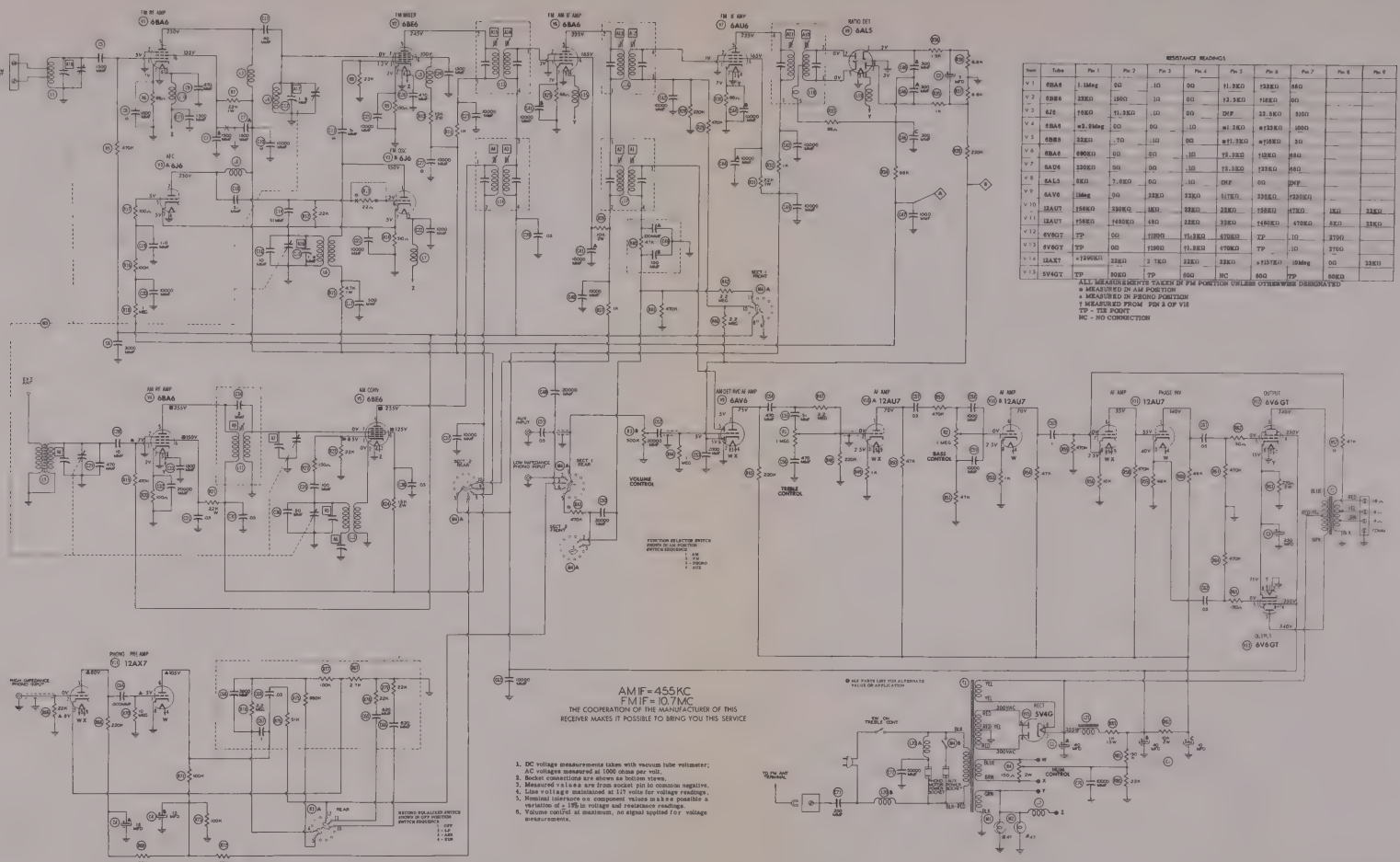


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6BA6	1.1Meg	0Ω	.1Ω	0Ω	11.2KΩ	123KΩ	68Ω		
V 2	6BE6	23KΩ	150Ω	.1Ω	0Ω	12.3KΩ	115KΩ	0Ω		
V 3	6J6	16KΩ	11.3KΩ	.1Ω	0Ω	INF	23.5KΩ	510Ω		
V 4	6BA6	∞2.9Meg	0Ω	0Ω	.1Ω	∞1.3KΩ	∞123KΩ	150Ω		
V 5	6BE6	22KΩ	.7Ω	.1Ω	0Ω	∞11.3KΩ	∞116KΩ	3Ω		
V 6	6BA6	690KΩ	0Ω	0Ω	.1Ω	12.3KΩ	112KΩ	68Ω		
V 7	6AD6	220KΩ	0Ω	0Ω	.1Ω	12.3KΩ	123KΩ	68Ω		
V 8	6AL5	8KΩ	7.8KΩ	0Ω	.1Ω	INF	0Ω	INF		
V 9	6AV6	1Meg	0Ω	33KΩ	33KΩ	51KΩ	330KΩ	330KΩ		
V 10	12AU7	156KΩ	230KΩ	1KΩ	22KΩ	22KΩ	156KΩ	47KΩ	1KΩ	33KΩ
V 11	12AU7	156KΩ	1480KΩ	68Ω	22KΩ	33KΩ	1480KΩ	470KΩ	1KΩ	33KΩ
V 12	6V6GT	TP	0Ω	1190Ω	11.3KΩ	470KΩ	TP	10Ω	270Ω	
V 13	6V6GT	TP	0Ω	1190Ω	11.3KΩ	470KΩ	TP	10Ω	270Ω	
V 14	12AX7	∞1240KΩ	22KΩ	2.7KΩ	22KΩ	33KΩ	∞157KΩ	10Meg	0Ω	33KΩ
V 15	5Y4GT	TP	80KΩ	TP	60Ω	NC	60Ω	TP	80KΩ	

ALL MEASUREMENTS TAKEN IN FM POSITION UNLESS OTHERWISE DESIGNATED
∞ MEASURED IN AM POSITION
▲ MEASURED IN PHONO POSITION
† MEASURED FROM PIN 3 OF V15
TP - TIE POINT
NC - NO CONNECTION

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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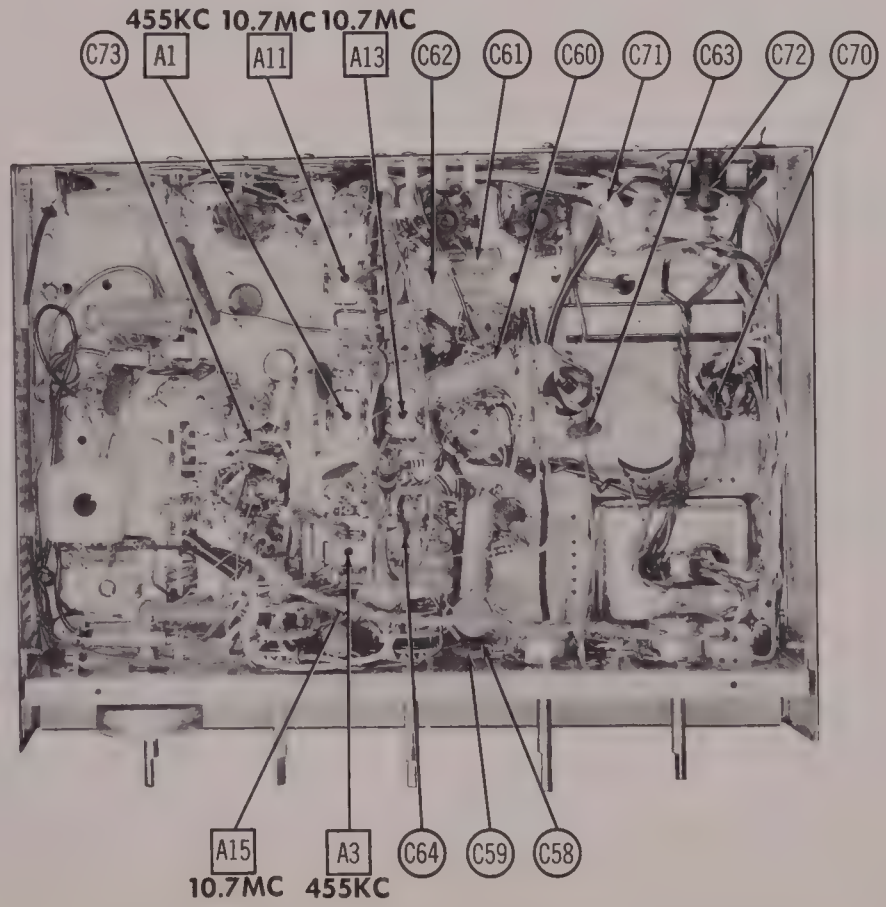
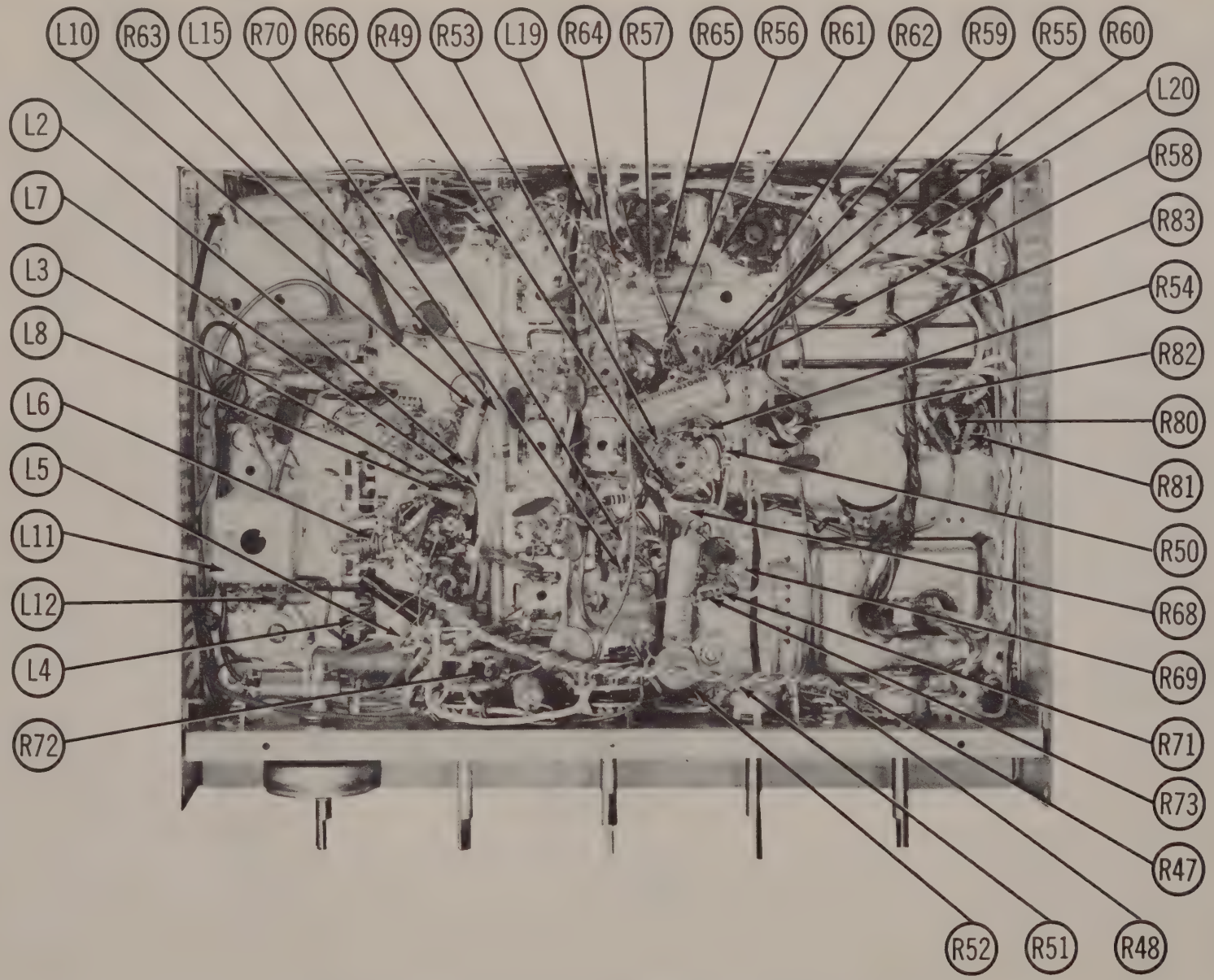
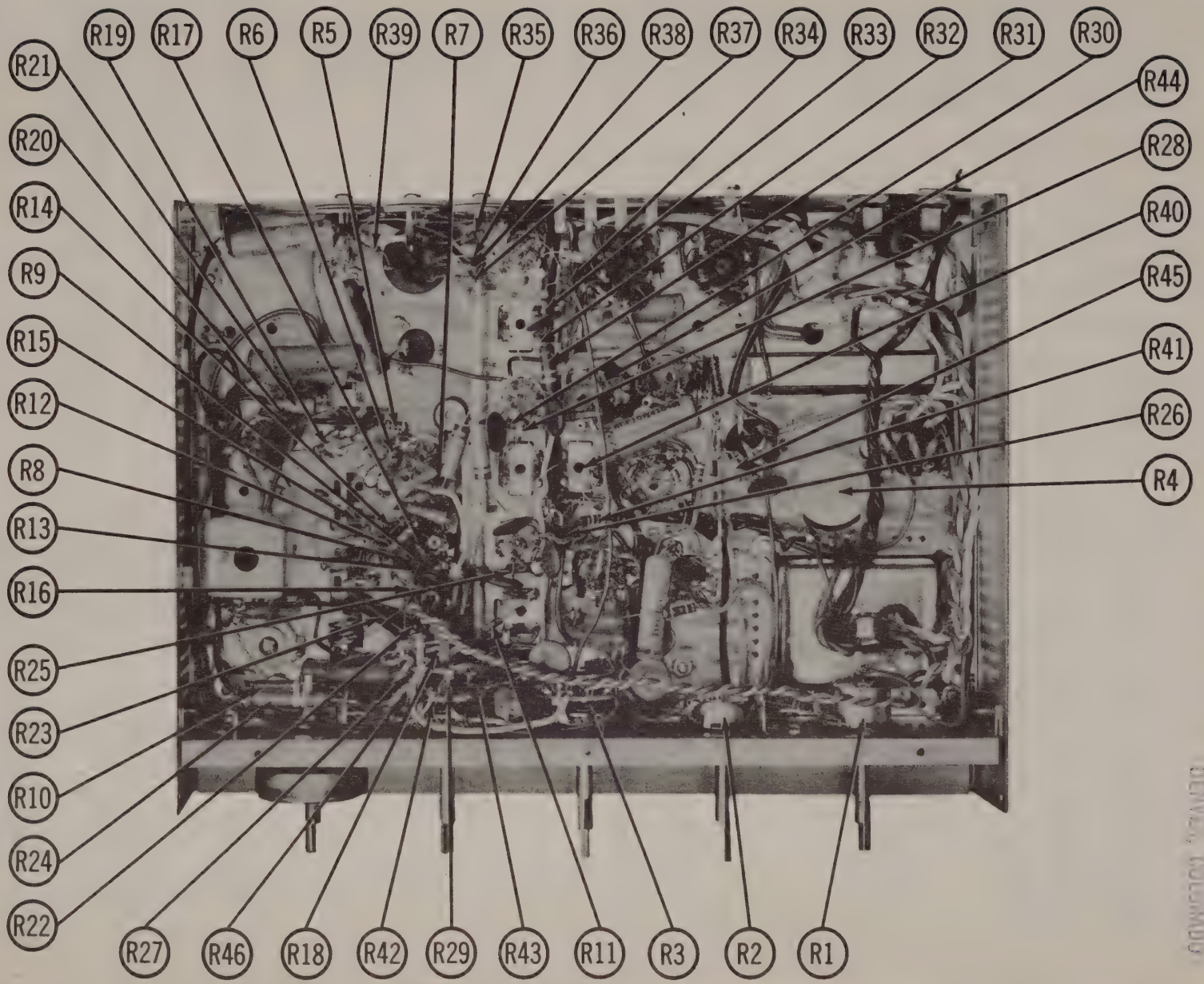


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

ESPEY
MODEL 201



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PROPERTY OF
F. C. A. WORKSHOP
DENVER, COLORADO

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: ESPEY PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	FM RF Amp.	6BA6	6BA6	7BK	
V2	FM Mixer	6BE6	6BE6	7CH	
V3	FM Osc.-AFC	6J6	6J6	7BF	
V4	AM RF Amp.	6BA6	6BA6	7BK	
V5	AM Converter	6BE6	6BE6	7CH	
V6	FM-AM IF Amp.	6BA6	6BA6	7BK	
V7	FM IF Amp.	6AU6	6AU6	7BK	
V8	Ratio Det.	6AL5	6AL5	6BT	
V9	AM Det.-AVC-AF Amp.	6AV6	6AV6	7BT	
V10	AF Amp.	12AU7	12AU7	9A	
V11	AF Amp.-Phase Inverter	12AU7	12AU7	9A	
V12	Audio Output	6V6GT	6V6GT	7S	
V13	Audio Output	6V6GT	6V6GT	7S	
V14	Phono Preamp.	12AX7	12AX7	9A	
V15	Rectifier	5V4G	5V4G	5L	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: ESPEY PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1A	▲40	450				FP376.8	TM-404010-450	T-165	
B	■40	450							
C	▲10	450							
C2	5	250				TC50X	TD-15-250	MMT-1505	
C3	250	50				WP057	TM-250-50	S-055	
C4A	■15	350				FP343.4	TM-D15-400	D-155	
B	▲15	350							
C	25	25							
C5	1500			D6-152	GP2L-152	UC-5215			
C6	3000			D6-302	GP2-333-302	UC-523			
C7A	1500								
B	1500								
C8	1500			D6-152	801-0015	UC-5215			Note 1
C9	470			DD-471	811-471	UC-5347			
C10	10000			DD-103	811-01	DC-511			Note 1
C11	40			TCZ-40	NP0K-390				
C12	1-8			829-7	532-10				Note 2
C13	51			TCZ-51	NP0-338-510	ZT-545			
C14	51			TCZ-51	NP0-338-510	ZT-545			
C15	1-8			829-7	532-10				
C16	10			TCZ-10	NP0K-100	ZT-541			
C17	1500			D6-152	GP2L-152	UC-5215			
C18	51			TCZ-51	NP0-338-510	ZT-545			
C19	110			TCZ-110	NP0-333-111				
C20	10000			DD-103	811-01	DC-511			
C21	10000			DD-103	811-01	DC-511			
C22	1000			DD-102	801-001	DC-521			
C23	10000			DD-103	811-01	DC-511			
C24	1500			DD-152	801-0015	DC-5215			
C25	10000			DD-103	811-01	DC-511			
C26	470			DD-471	811-471	UC-5347			
C27	10000			DD-103	811-01	DC-511			Note 1
C28	10			TCZ-10	NP0A-100	ZT-541			
C29	470			DD-471	811-471	UC-5347			
C30	.05	400		DF-503		PT415	IMP4-S5	330415	
C31	.05	400		DF-503		PT415	IMP4-S5	330415	
C32	20000			DD-203	817-02				
C33	1500			DD-152	801-0015				
C34	5			TCZ-5	NP0A-050	ZT-555			
C35	100			TCZ-100	NP0-337-101	ZT-531			
C36	20			TCZ-20	NP0K-200	ZT-542			
C37	10000			DD-103	811-01	DC-511			
C38	.05	400		DF-503		PT415	IMP4-S5	330415	

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: ESPEY PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R5	470KΩ	½		BTS-470K	
R6	68Ω	½		BTS-68	
R7	22KΩ	1		BTA-22K	
R8	22KΩ	½		BTS-22K	
R9	150Ω	½		BTS-150	
R10	15KΩ	2		BTB-15K	
R11	1000Ω	½		BTS-1000	
R12	22KΩ	½		BTS-22K	
R13	22Ω	½		BTS-22	Note 1
R14	510Ω 5%	½		BTS-510 5%	
R15	4700Ω	1		BTA-4700	
R16	100KΩ	½		BTS-100K	
R17	100Ω	½		BTS-100	
R18	1Meg	½		BTS-1Meg	
R19	470KΩ	½		BTS-470K	
R20	100Ω	½		BTS-100	
R21	22KΩ	1		BTA-22K	
R22	22KΩ	½		BTS-22K	
R23	150Ω	½		BTS-150	
R24	15KΩ	2		BTB-15K	
R25	68Ω	½		BTS-68	
R26	10KΩ	2		BTB-10K	
R27	1000Ω	½		BTS-1000	
R28	220KΩ	½		BTS-220K	
R29	470KΩ	½		BTS-470K	
R30	68Ω	½		BTS-68	
R31	22KΩ	1		BTA-22K	
R32	1000Ω	½		BTS-1000	
R33	68Ω	½		BTS-68	
R34	68KΩ	½		BTS-68K	
R35	1000Ω	½		BTS-1000	
R36	1500Ω	½		BTS-1500	
R37	6800Ω	½		BTS-6800	
R38	6800Ω	½		BTS-6800	
R39	220KΩ	½		BTS-220K	
R40	47KΩ	½	♦	BTS-47K	
R41	470KΩ	½		BTS-470K	
R42	2.2Meg	½		BTS-2.2Meg	
R43	470KΩ	½		BTS-470K	Note 2

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: ESPEY PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R44	1Meg	½		BTS-1Meg	
R45	220KΩ	½		BTS-220K	
R46	2.2Meg	½		BTS-2.2Meg	
R47	2.2Meg	½		BTS-2.2Meg	
R48	220KΩ	½		BTS-220K	
R49	1000Ω	½		BTS-1000	
R50	47KΩ	½		BTS-47K	
R51	47KΩ	½		BTS-47K	
R52	470KΩ	½		BTS-470K	
R53	1000Ω	½		BTS-1000	
R54	47KΩ	½		BTS-47K	
R55	470KΩ	½		BTS-470K	
R56	10KΩ	½		BTS-10K	
R57	47KΩ	½		BTS-47K	Note 3
R58	470KΩ	½		BTS-470K	
R59	48KΩ	½			
R60	48KΩ	½			
R61	470KΩ	½		BTS-470K	
R62	150Ω	½		BTS-150	
R63	270Ω	2		BTB-270	
R64	470KΩ	½		BTS-470K	
R65	150Ω	½		BTS-150	
R66	22KΩ	½		BTS-22K	
R67	2700Ω	½		BTS-2700	
R68	220KΩ	½		BTS-220K	
R69	22KΩ	½		BTS-22K	
R70	10Meg	½		BTS-10Meg	
R71	100KΩ	½		BTS-100K	
R72	47KΩ	½		BTS-47K	
R73	100KΩ	½		BTS-100K	
R74	2.2Meg	½		BTS-2.2Meg	
R75	680KΩ	½		BTS-680K	
R76	51KΩ	½		BTS-51K 5%	
R77	100KΩ	½		BTS-100K	
R78	22KΩ	½		BTS-22K	
R79	22KΩ	½		BTS-22K	
R80	22KΩ	½		BTS-22K	
R81	150KΩ 5%	½		BTS-150K 5%	
R82	10KΩ	2		BTB-10K	
R83	1000Ω	1			

♦ Items R40, C49A, C49B are combined in one unit.
Note 1. Not used in some versions.
Note 2. Some versions use a 2.2Meg resistor in this application.
Note 3. Some versions use a 10KΩ resistor in this application.

TRANSFORMER (POWER)

ITEM No.	RATING: PRI.	RATING: SEC. 1	RATING: SEC. 2	RATING: SEC. 3	REPLACEMENT DATA: ESPEY PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @.92A	576VCT .135ADC	5VAC @ 2A	6.3VAC @.85A SEC. 4 6.3VAC @3.55A	B18.126				25R16	

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE: PRI.	IMPEDANCE: SEC.	REPLACEMENT DATA: ESPEY PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T2	6KΩ CT	500Ω tap @ 8Ω,4Ω	B15.148						

PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS (cont)

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA ESPEY PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C39	.05	400		DF-503		PT415	IMP4-S5	330415	
C40	10000			DD-103	811-01	DC-511			
C41A	10000			DD3-103	811-01	DC-511			
B	10000				811-01	DC-511			
C42	10000			DD-103	811-01	DC-511			
C43	10000			DD-103	811-01	DC-511			
C44A	10000			DD-103	811-01	DC-511			
B	10000			DD-103	811-01	DC-511			
C45	10000			DD-103	811-01	DC-511			
C46A	300		♦	DD-301	811-301	UC-533		K-1330	
B	300			DD-301	811-301	UC-533		K-1330	
C	300			DD-301	811-301	UC-533		K-1330	
C47	1000			DD-102	801-001	DC-521		K-1210	
C48	20000			DD-203	817-02	PT412	IMP4-S2	330412	
C49A	100		‡	‡PC-50	‡1403-01	UC-531		K-1310	
B	100					UC-531		K-1310	
C50	20000			DD-203	817-02	PT412	IMP4-S2	330412	
C51	.05	400		DF-503		PT415	IMP4-S5	330415	
C52	20000			DD-203	817-02	PT412	IMP4-S2	330412	
C53	2000			D6-202	GP2-333-202	UC-522		C-1220	
C54	470			DD-471	811-471	UC-5347		K-1347	
C55	51			TCZ-51	N750K-510	ZT-545		KR-1451	
C56	470			DD-471	811-471	UC-5347		K-1347	
C57	.03	400		DF-303		PT413	IMP4-S3	330413	
C58	1000			DD-102	801-001	DC-521		K-1210	
C59	10000			DD-103	811-01	DC-511	IMP4-S1	330411	
C60	.1	400		DF-104		PT401	IMP4-P1	330401	
C61	.05	400		DF-503		PT415	IMP4-S5	330415	
C62	.05	400		DF-503		PT415	IMP4-S5	330415	
C63	10000			DD-103	811-01	DC-511			
C64	1500			DD-152	801-0015	DC-5215	IMP6-D15	C-1215	
C65	820	500						KR-1382	
C66	820	500						KR-1382	
C67	.1	400		DF-104		PT401	IMP4-P1	330401	
C68	3900	500						CR-1239	
C69	.03	400		DF-303		PT413	IMP4-S3	330401	
C70	10000			DD-103	811-01	DC-511	IMP6-S1		
C71	250	500				MC240		K-1325	
C72	50000	400				PT415		330415	
C73	1500			D6-152	GP2L-152	UC-5215	IMP6-D15	C-1215	

♦ Items C46A, C46B, C46C are combined in one unit.
‡ Items C49A, C49B and R40 are combined in one unit.
Note 1. Not used in some versions.
Note 2. Some versions use a 20MMF capacitor in this application.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA ESPEY PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1Meg	½	A9.317-A	Q13-137	A47-1Meg-Z	B-70-S	U-53	Treble
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R1A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R1A
R2A	1Meg	½	A9.129	Q13-137	A47-1Meg-Z	B-70	U-53	Bass
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R2A
R3A	Switch		B9.311-A					Equalizer Switch-Panel
B	500KΩ	½						Volume-Rear
R4A	100Ω	2	A9.310-A	W100	A43-100	VK-121	R100L	Hum Balance-wirewound
B	Shaft		Not Req.	Not Req.	FKS-1/4	Not Req.	Not Req.	Attach to R4A

PARTS LIST AND DESCRIPTIONS (Continued)

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA ESPEY PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	FM Ant. Coil	0Ω						Tapped
L2	Fil. Choke	.4Ω			19-1001		4604	1.5 Microhenries
L3	RF Choke	.4Ω			19-1001		4604	1.5 Microhenries
L4	FM RF Coil	0Ω						Tapped
L5	RF Choke	1Ω						
L6	FM Osc. Coil	0Ω	0Ω					
L7	Fil. Choke	.4Ω			19-1001		4604	1.5 Microhenries
L8	RF Coil	2.2Ω			19-1003		4608	3 Microhenries
L9	AM Ant. Coil	.3Ω						Tapped
L10	Fil. Choke	.4Ω			19-1001		4604	1.5 Microhenries
L11	AM RF Coil	77Ω	3Ω					
L12	AM Osc. Coil	.7Ω	6.5Ω		14-1074	BC-394	70-OSC	
L13	1st. FM IF	.6Ω	.6Ω	2.415	16-3487	FM-254	1463	
L14	1st. AM IF	9.5Ω	9.5Ω	2.415	16-6758	BC-352	12-C1	
L15	Fil. Choke	.4Ω			19-1001		4604	1.5 Microhenries
L16	2nd. FM IF	.6Ω	.6Ω	2.415	16-3487	FM-254	1463	
L17	2nd. AM IF	9.5Ω	9.5Ω	2.414	16-6758	BC-353	12-C2	
L18	Ratio Det.	1.5Ω	.8ΩCT	2.474	17-3488 *	FM-255	1465	Tertiary winding -.4Ω
L19	Fil. Choke	.4Ω			19-1001		4604	1.5 Microhenries
L20A	Line Choke	0Ω						
B	Line Choke	0Ω						

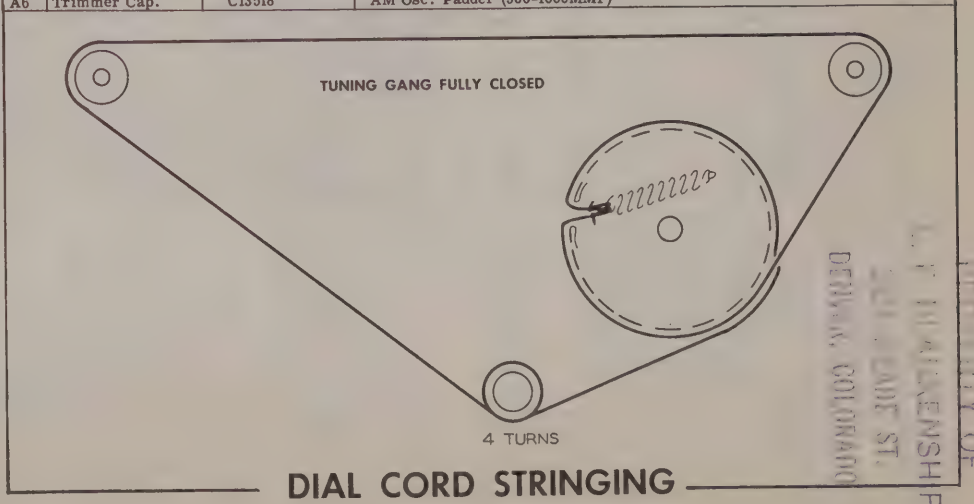
* Drill mounting holes.

FILTER CHOKE

ITEM No.	RATINGS TOTAL DIRECT CURRENT	RATINGS D. C. RESISTANCE	RATINGS INDUCTANCE (0 CURRENT 1000 ~)	REPLACEMENT DATA ESPEY PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
L21	.080A	276Ω	10.2 HY	B16.353					

MISCELLANEOUS

ITEM No.	PART NAME	ESPEY PART No.	NOTES
M1	Dial Light		#47
M2	Dial Light		#47
M3	Tuning Gang	B6.070	6 Gang (AM sections - 30-535MMF, 30-535MMF, 30-535MMF)
M4A	Switch		Selector
B	Switch		On-off-(Power) Auxiliary outlet
A6	Trimmer Cap.	C13518	AM Osc. Padder (500-1000MMF)



DIAL CORD STRINGING

COURTESY OF
E. F. MACKENSHP
2121 EAST ST.
COLORADO

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

To set pointer, turn tuning capacitor fully closed and set pointer to last reference mark at low frequency end of dial.
Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading.
Use an insulated alignment screwdriver for adjusting.

AM ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1.	.01MFD	High side to pin 1 (grid) of 6BA6 (V6). Low side to chassis.	455KC (400∿Mod)	AM	Tuning gang fully open	Across voice coil	A1, A2	Adjust for maximum output.
2.	"	High side to pin 7 (grid) of 6BE6 (V5). Low side to chassis.	"	"	"	"	A3, A4	"
3.	5MMF	High side thru 5MMF to AM antenna terminal lug. Low side to chassis.	1700KC	"	1700KC	"	A5	"
4.	"	"	550KC	"	550KC	"	A6	Adjust for maximum output. Repeat steps 3 and 4 until proper oscillator tracking is obtained.
5.	"	"	1550KC	"	1550KC (small index mark to the right of "150" on dial)	"	A7, A8	Adjust for maximum output.
6.	"	"	600KC	"	600KC	"	A9	Adjust for maximum output. Repeat steps 5 and 6 until proper RF tracking is obtained.

FM IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
7.	.01MFD	High side to pin 1 (grid) of 6AU6 (V7). Low side to chassis.	10.7MC (Unmod)	FM	Point of non-interference	DC probe to point A . Common to chassis.	A10	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.
8.	"	"	"	"	"	DC probe to point B . Common to chassis.	A11	Adjust for maximum deflection. Repeat steps 7 and 8.
9.	"	High side to pin 1 (grid) of 6BA6 (V6). Low side to chassis.	"	"	"	"	A12, A13	Adjust for maximum deflection.
10.	"	High side to pin 7 (grid) of 6BE6 (V2). Low side to chassis.	"	"	"	"	A14, A15	Adjust for maximum deflection. Repeat steps 9 and 10.

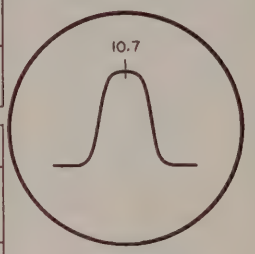


FIG. 1

FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60∿ modulation and 450KC sweep. Use 120∿ sawtooth voltage in scope for horizontal deflection.
Use only enough generator signal to provide useable pattern on scope.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT SCOPE	ADJUST	REMARKS
7.	.01MFD	High side to pin 1 (grid) of 6BA6 (V6). Low side to chassis.	10.7MC (450KC Swp)	FM	Point of non-interference	Vert. Amp. to point B . Low side to chassis.	A11, A12, A13	Disconnect stabilizing capacitor (C2). Adjust for curve of maximum amplitude and symmetry similar to Fig. 1.
8.	"	High side to pin 7 (grid) of 6BE6 (V2). Low side to chassis.	"	"	"	"	A14, A15	"
9.	"	"	"	"	"	Vert. Amp. to point A . Low side to chassis.	A10	Reconnect stabilizing capacitor (C2). Adjust A10 so that 10.7MC occurs at center of crossover lines, similar to Fig. 2. SLIGHTLY retouch A-11 for maximum amplitude and straightness of crossover lines. Proceed with step 11.

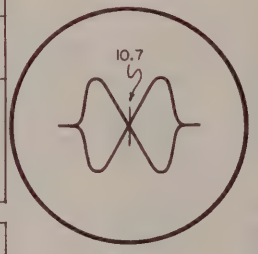


FIG. 2

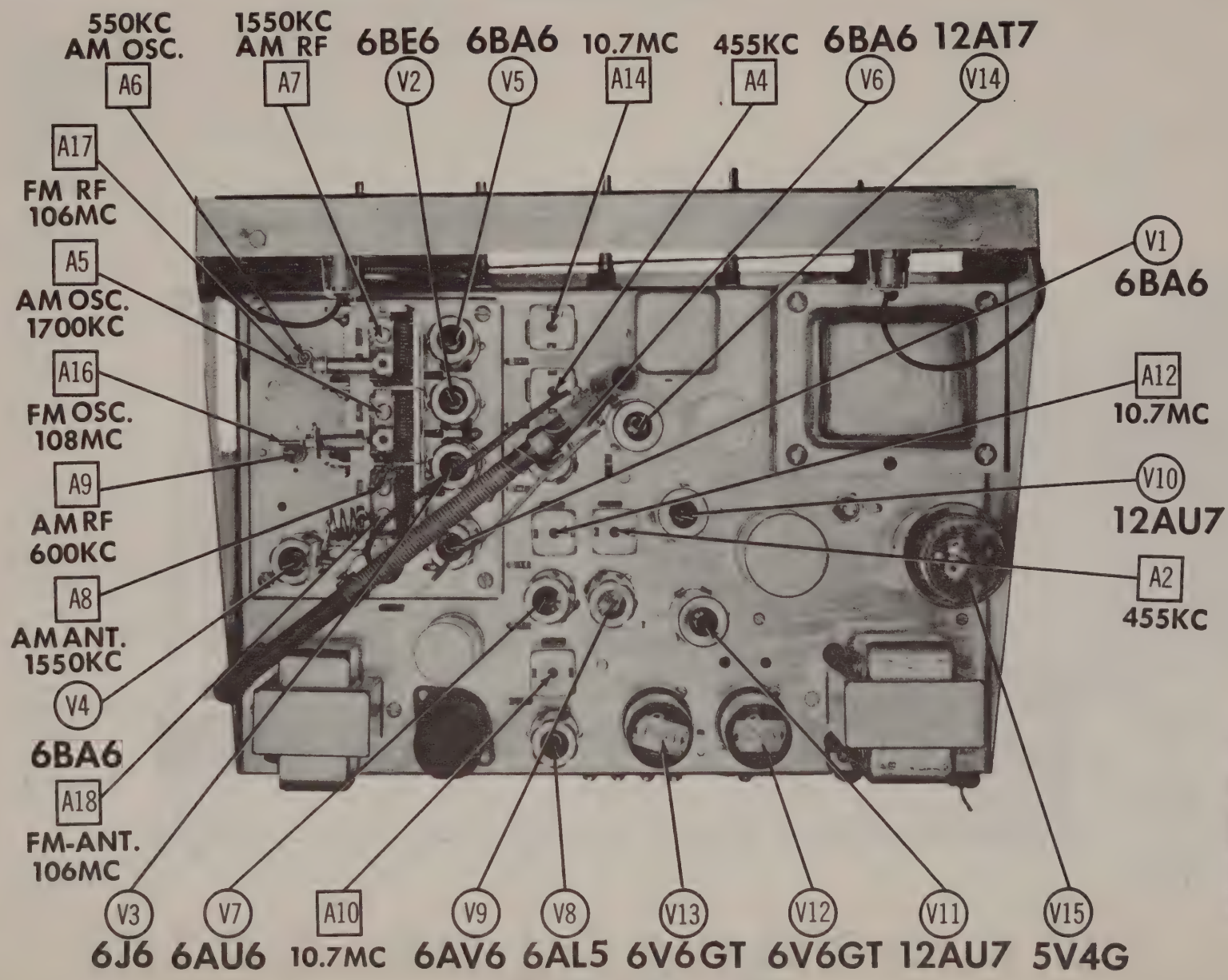
FM RF ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
11.	270Ω Carbon Resistors	High side thru 270Ω to FM antenna lug. Low side to chassis.	108MC (Unmod)	FM	108MC	DC probe to point B . Common to chassis.	A16	Adjust for maximum deflection.
12.	"	"	106MC	"	106MC	"	A17, A18	"
13.	"	"	90MC	"	90MC	"		Check L4 and L1 with tuning wand. If necessary compress or expand for maximum deflection.

HUM BALANCE ADJUSTMENT

If it becomes necessary to readjust the hum balance control (R4A) allow a 10 minute warm-up period with record player disconnected and perform the following operation:

a. Set function switch to "Phono" position.
b. Set record equalizer to "AES" position.
c. Turn volume control fully clockwise.
d. Reverse line plug in AC outlet and leave in that position which gives least residual hum.
e. Adjust R4A for MINIMUM background noise residual hum.



CHASSIS TOP VIEW

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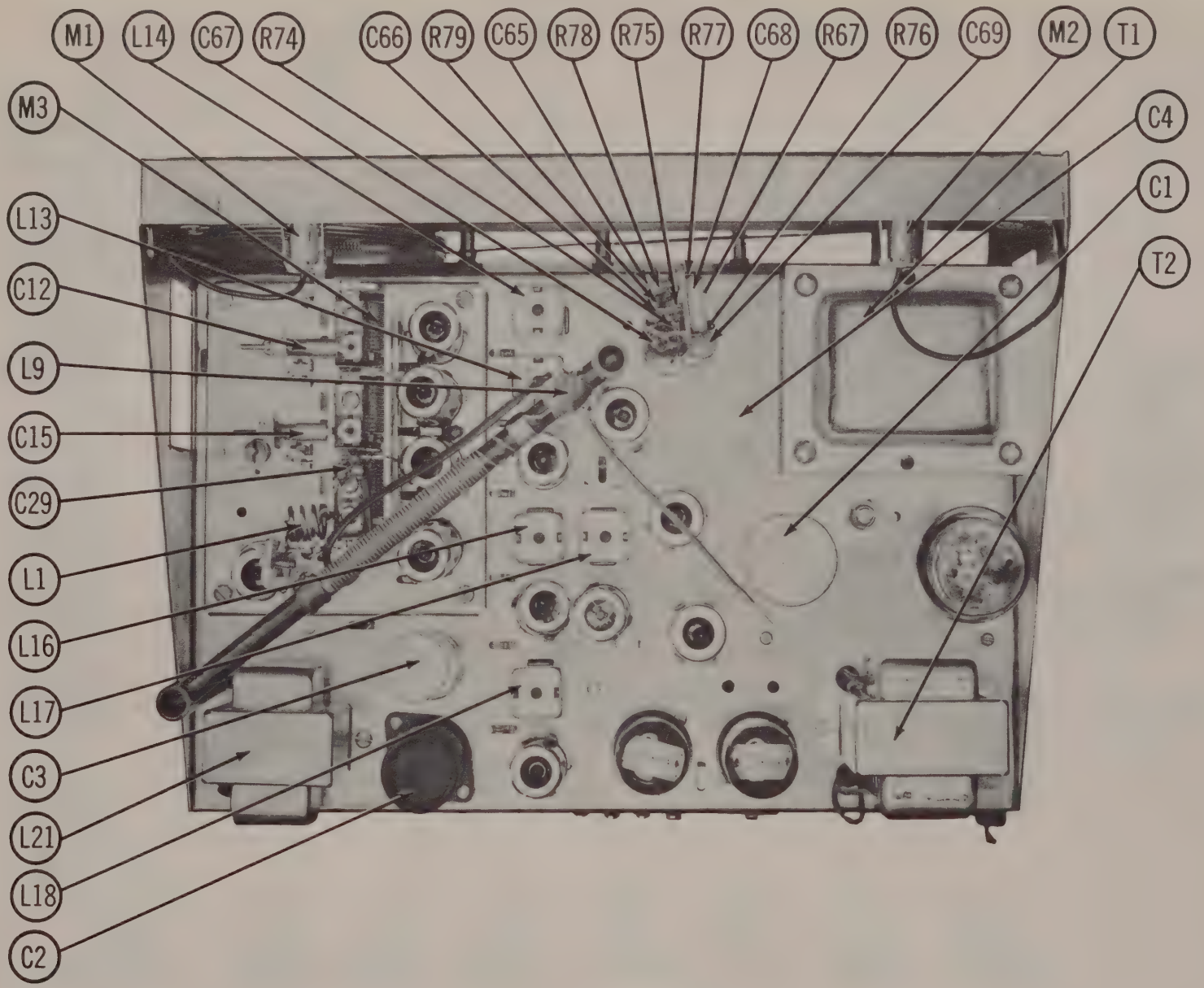

CHASSIS-TOP VIEW

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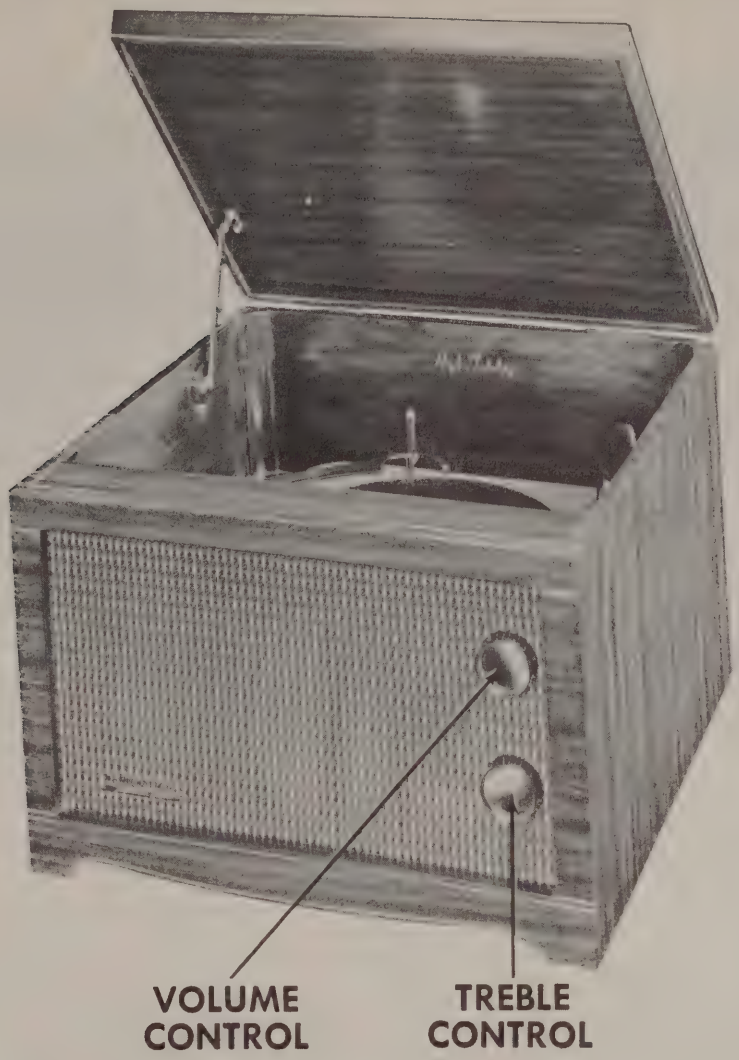
DENVER, COLORADO

HALLICRAFTERS MODELS
3HFP-1, 3HFP-2 (Run 1)



HALLICRAFTERS MODELS
3HFP-1, 3HFP-2 (Run 1)

TRADE NAME	Hallicrafters Models 3HFP-1, 3HFP-2 (Run 1)
MANUFACTURER	The Hallicrafters Co., 4401 W. 5th. Ave., Chicago 24, Ill.
TYPE SET	AC Operated Phono Amplifier With 3 Speed Automatic Record Changer
TUBES (Three)	Types 12AX7 AF Amp.-Phase Inverter, (2) 35C5 Audio Output
POWER SUPPLY	105-120 Volts AC-60 Cycles RATING .30 Amp. @ 117 Volts AC

FOR SERVICE INFORMATION ON HALLICRAFTERS RECORD CHANGER UNIT 115E156-SEE SIMILAR V-M MODEL 950-PHOTOFACT SET 216 — FOLDER 11 OR RECORD CHANGER MANUAL CM-5.

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

HALLICRAFTERS
MODEL 3HFP-1

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		Hallicrafters PART No.	STANDARD REPLACEMENT		
V1	AF Amplifier-Phase Inverter	12AX7	12AX7	9A	
V2	Audio Output	35C5	35C5	7CV	
V3	Audio Output	35C5	35C5	7CV	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT	Hallicrafters PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1A	50	150	45C259			TCT3118	TM-T50-150	[FMD-1550 FM-1550	Red
B	50	150							Green
C	50	150							Yellow
C2	.05	200	46AU503J	DF-503		PT415	IMP2-S5	330215	
C3	.02	200	46AU203J	DF-203	817-02	PT412	IMP2-S2	330212	
C4	.05	200	46AU503J	DF-503		PT415	IMP2-S5	330215	
C5	.05	200	46AU503J	DF-503		PT415	IMP2-S5	330215	
C6	.5	25	46A177			RF481	CT2-P5	330205	
C7	.05	600	46AY503J	DF-503		PT615	IMP6-S5	330615	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Hallicrafters PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	3.25Meg	½	25B1092	Q13-140	A47-4Meg-Z	AB-85	U-57	Volume
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R1A
R2A	100KΩ	½	25B1093	Q11-128	A47-100K-S	AB-40	U-41	Treble
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R2A

RESISTORS

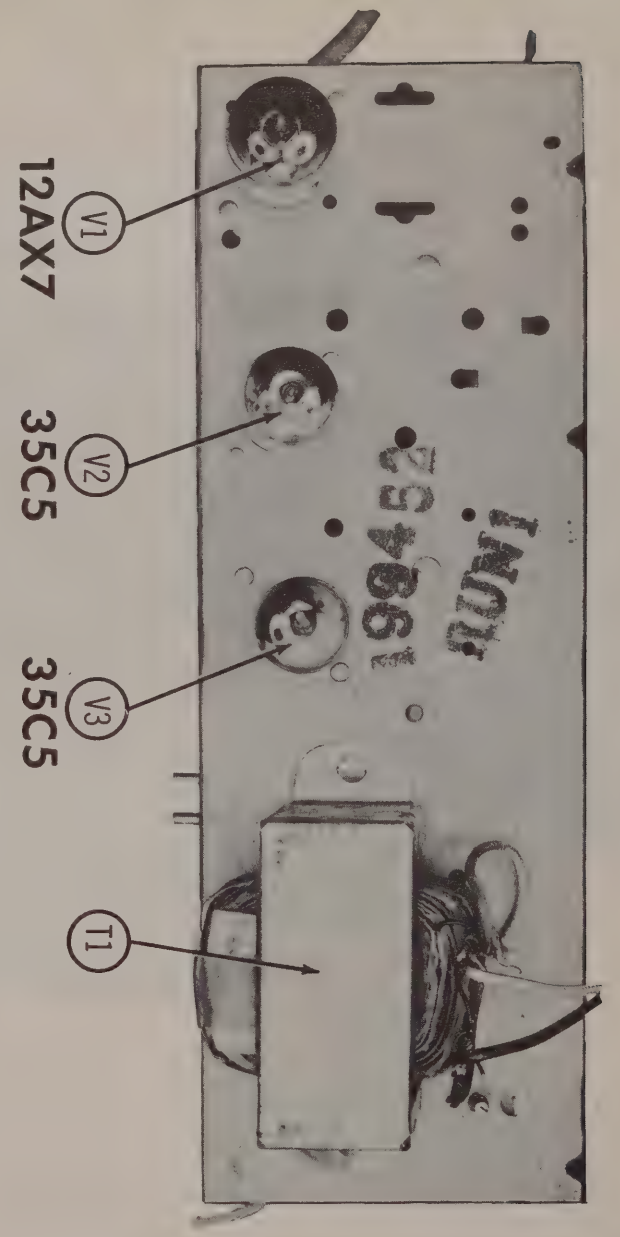
ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Hallicrafters PART No.	IRC PART No.	
R3	4700Ω 5%	½	23X20X472K	BTS-4700 5%	
R4	270KΩ	½	23X20X224K	BTS-220K	
R5	47KΩ	½	23X20X473K	BTS-47K	
R6	10KΩ	½	23X20X103K	BTS-10K	
R7	220KΩ	½	23X20X224K	BTS-220K	
R8	470KΩ	½	23X20X474K	BTS-470K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Hallicrafters PART No.	IRC PART No.	
R9	100Ω	2	23X40X101K		
R10	470KΩ	½	23X20X474K	BTS-470K	
R11	27KΩ	½	23X20X273K	BTS-27K	
R12	225Ω	7	24A994	1 3/4A-225	
R13	15Ω	½	23X20X150K	BTS-15	
R14	100Ω	2	23X40X101K		
R15	3300Ω	½	23X20X332K	BTS-3300	

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	Hallicrafters PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T1	4.8KΩ CT	8Ω	55D252	Z1011	A-2904❍	A-3870	22S60 ①	S-55X	① Drill one new mounting hole.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA		NOTES
	SIZE	FIELD	V. C. IMP.	Hallicrafters PART No.	QUAM PART No.	
SP1	7"	PM	8Ω	85C176	6A31Z8	
SP2	3½"	PM	16Ω	85C173	3A15T	

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	Hallicrafters PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M1	.070A	27A161	1004A	RS100	6S100	5M1	100	

PHONO CARTRIDGE

ITEM No.	REPLACEMENT DATA					REMARKS
	Hallicrafters PART No.	ASTATIC PART No.		ELECTRO-VOICE PART No.		
		CARTRIDGE	NEEDLE	CARTRIDGE	NEEDLE	
M2	93A563	55-T	GD-J	47	0-1 or S-1 & 0-3	

ASTATIC AND ELECTRO-VOICE NEEDLE LISTINGS SHOWN ABOVE ARE SPECIFIED FOR THE RESPECTIVE REPLACEMENT CARTRIDGES LISTED. FOR ORIGINAL CARTRIDGE NEEDLE REPLACEMENT SEE BELOW.

PHONO NEEDLE

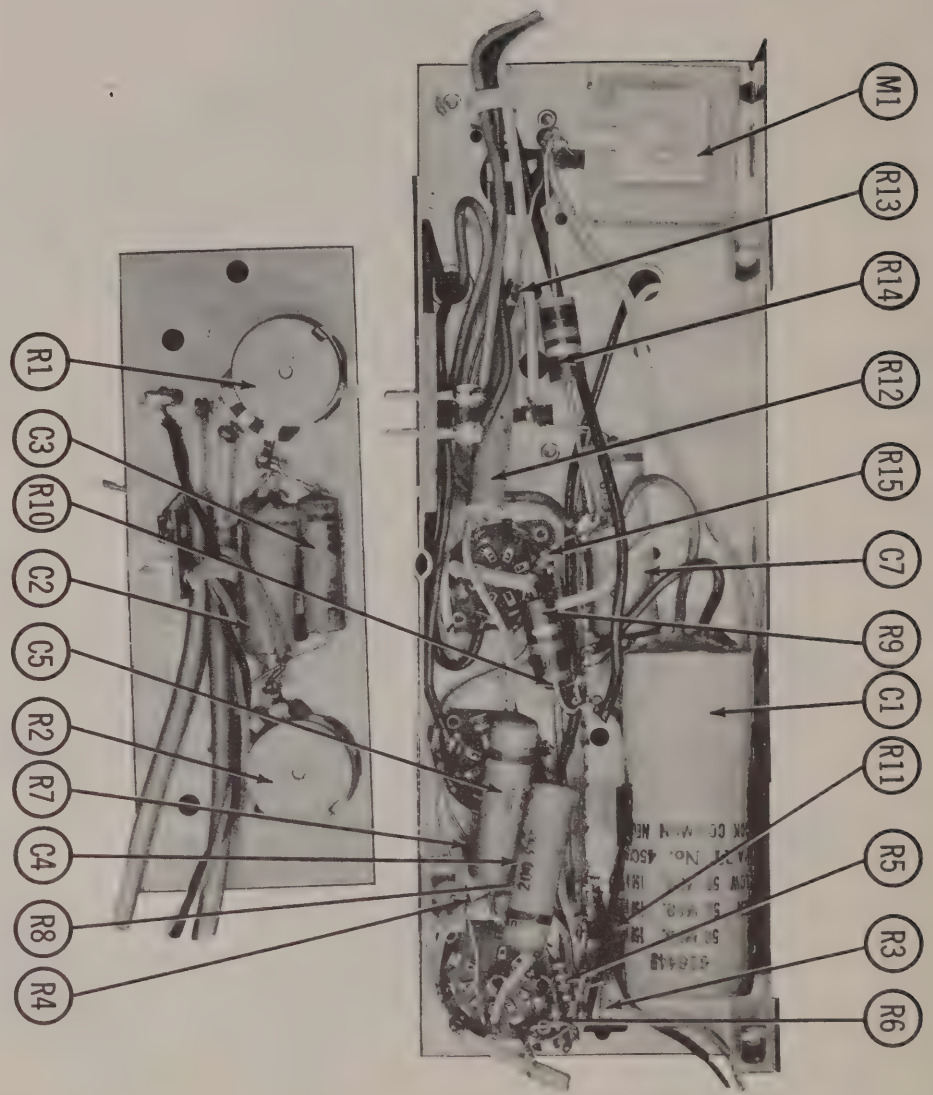
(FOR REPLACEMENT IN ORIGINAL EQUIPMENT CARTRIDGE)

ITEM No.	REPLACEMENT DATA				REMARKS
	Hallicrafters PART No.	JENSEN PART No.	PERMO PART No.	WALCO PART No.	
M3	121A946	*S-67 or †S-66 or ♦†S-66SD or ♦S-66D	†AC-434 or ♦†AC-434D1 or †♦AC-434D2 or ♦AC-434D	†W-75TPS or ♦†W-75DS or ♦W-75TPD	* Metal † Jewel ♦ Diamond

MISCELLANEOUS

ITEM No.	PART NAME	Hallicrafters PART No.	NOTES
	Cabinet	78F1126	Model 3HFP-1
	Cabinet	78F1127	Model 3HFP-2
	Knob	15A778	Volume - Model 3HFP-1
	Knob	15B776	Volume - Model 3HFP-2
	Knob	15A779	Treble - Model 3HFP-1
	Knob	15B777	Treble - Model 3HFP-2

CHASSIS—BOTTOM VIEW



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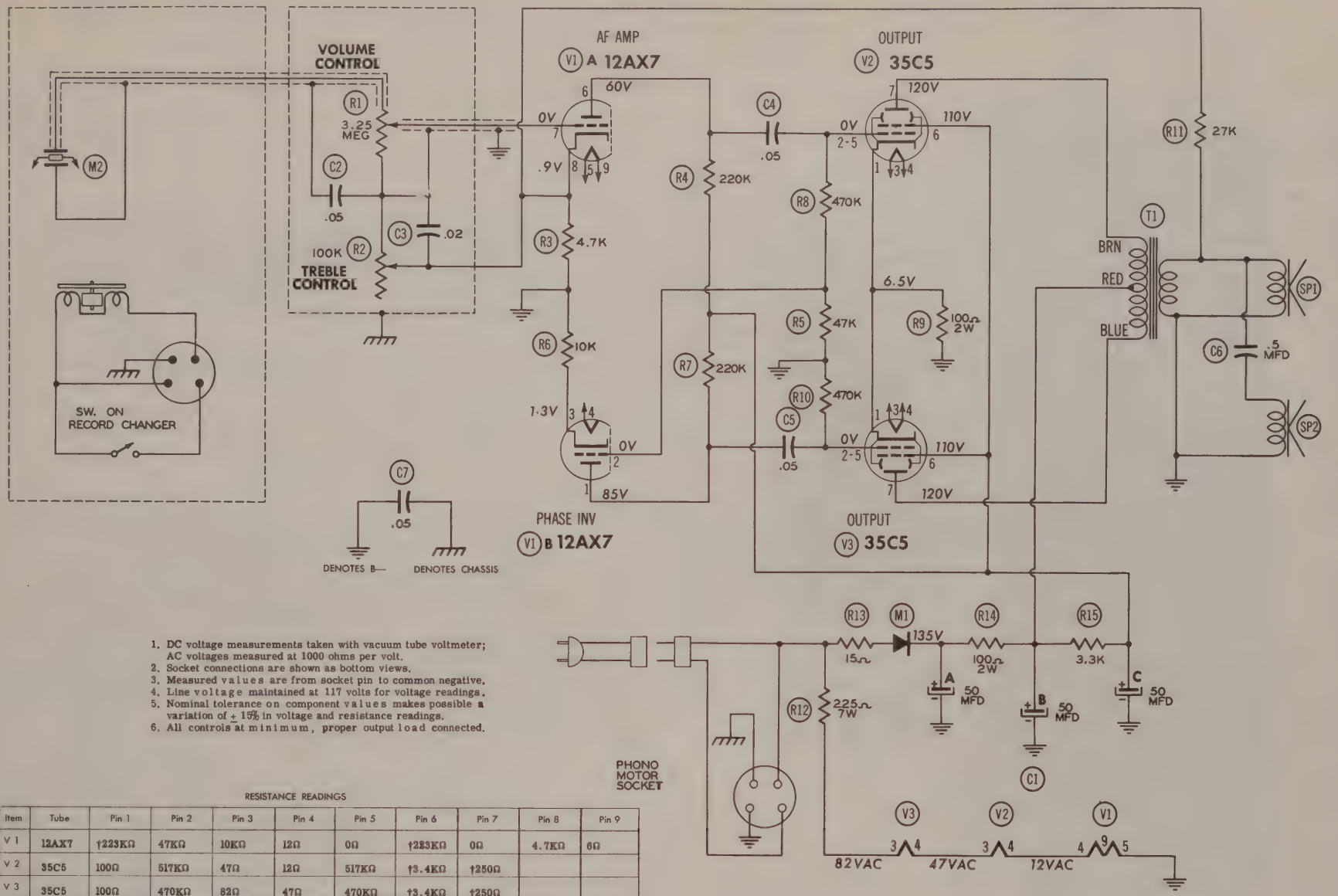

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AX7	†223KΩ	47KΩ	10KΩ	12Ω	0Ω	†223KΩ	0Ω	4.7KΩ	6Ω
V 2	35C5	100Ω	517KΩ	47Ω	12Ω	517KΩ	†3.4KΩ	†250Ω		
V 3	35C5	100Ω	470KΩ	82Ω	47Ω	470KΩ	†3.4KΩ	†250Ω		

ALL MEASUREMENTS TAKEN WITH PHONO MOTOR DISCONNECTED.
† MEASURED FROM OUTPUT OF M1

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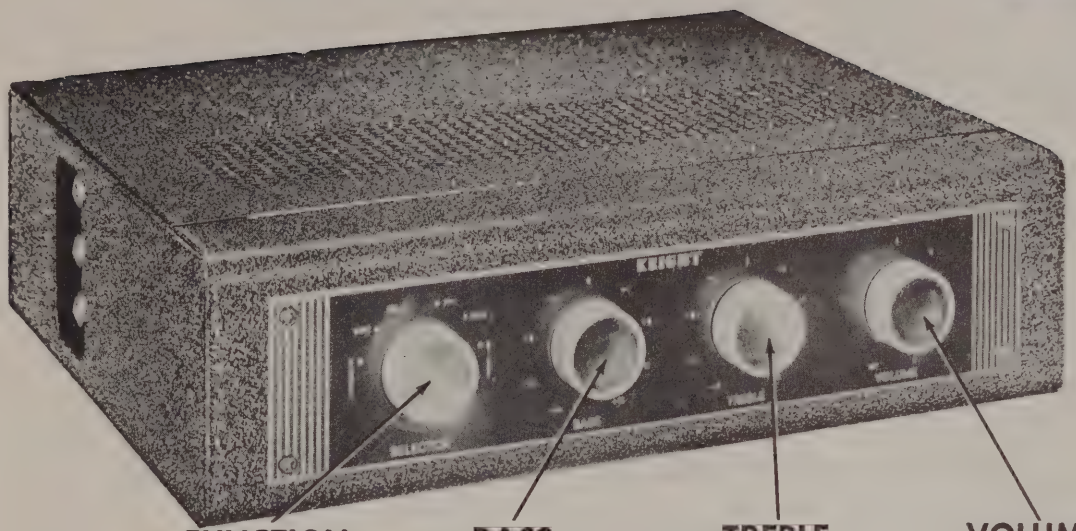

KNIGHT
MODEL 93SX312

TRADE NAME	Knight Model 93SX312
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
TYPE SET	AC Operated 4 Channel 12 Watt Audio Amplifier
TUBES (Six)	Types 12AX7 Phono Preamp.-AF Amp., 12AX7 Cath. Fol.-AF Amp., 12AX7 AF Amp.-Phase Inv., (2) 6V6GT Output, 5Y3GT Rectifier
POWER SUPPLY	117/130 Volts AC-50/60 Cycles RATING .44 Amp. @ 117 Volts AC

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PARTS LIST AND DESCRIPTIONS

KNIGHT MODEL 93SX312

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		KNIGHT PART No.	STANDARD REPLACEMENT		
V1	Phono Pre-Amp.-AF Amplifier	12AX7	12AX7	9A	
V2	Cathode Follower-AF Amplifier	12AX7	12AX7	9A	
V3	AF Amplifier-Phase Inverter	12AX7	12AX7	9A	
V4	Output	6V6GT	6V6GT	7S	
V5	Output	6V6GT	6V6GT	7S	
V6	Rectifier	5Y3GT	5Y3GT	5T	

CAPACITORS

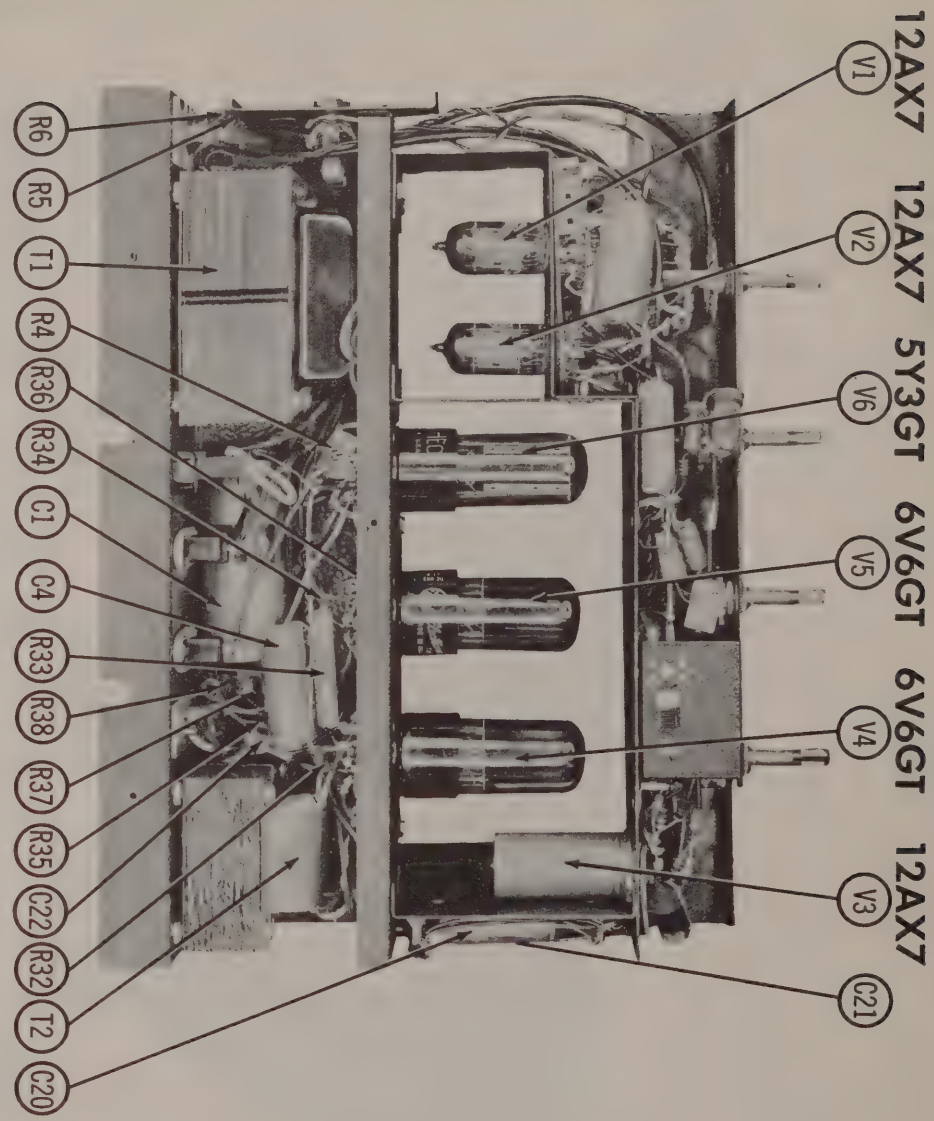
Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT	KNIGHT PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1A	40	450				FP475.5	TM-4052	Q-055	
B	10	450							
C	10	450							
D	10	450							
C2	8	450				TC71	TD-8-450	FM-4508	
C3	40	25				TC29	TD-50-25	FM-0250	
C4	40	25				TC29	TD-50-25	FM-0250	
C5	.033	600		DF-303		PT613	IMP6-S3	330613	
C6	.0033	600		D6-332	GP2-333-332	PT6233	IMP6-D33	3306233	
C7	470			DD-471	GP2L-471	UC-5347		CR-1347	
C8	.0022	600		D6-222	GP2-333-222	PT6222	IMP6-D22	3306222	
C9	.001	600		D6-102	GP2L-102	PT621	IMP6-D1	330621	
C10	.01	600		D6-103	GP2-333-103	PT611	IMP6-S1	330611	
C11	.047	600		DF-503		PT6147	IMP6-S47	3306147	
C12	.0056	200		D6-562	GP2-333-562	PT6256	IMP6-D56	3306256	
C13	.056	200				PT4156	IMP2-S56	3304156	
C14	330	500						CR-1333	
C15	150	500						CR-1315	
C16	.0033	600		D6-332	GP2-333-332	PT6233	IMP6-D33	3306233	
C17	.047	600		DF-503		PT6147	IMP6-S47	3306147	
C18	.01	600		D6-103	GP2-333-103	PT611	IMP6-S1	330611	
C19	.047	600		DF-503		PT6147	IMP6-S47	3306147	
C20	.047	600		DF-503		PT6147	IMP6-S47	3306147	
C21	.047	600		DF-503		PT6147	IMP6-S47	3306147	
C22	47	500						CR-1447	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	KNIGHT PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	500KΩ	½	RP-504AD	Q18-133X	A47F1-500K	ABT-62	UT429	Volume-tapped @ 50KΩ
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R1A
C	Switch		Not Req.	76-1	SWE-12	KB-1	US-26	Attach to R1A
R2A	500KΩ	½	RP-504AE	Q13-133	A47-500K-Z	AB-60	U-48	Treble
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R2A
R3A	500KΩ	½	RP-504AE	Q13-133	A47-500K-Z	AB-60	U-48	Bass
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R3A
R4	200Ω	1.5						Hum Balance- wire-wound

CHASSIS—BOTTOM VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA KNIGHT PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R5	22KΩ	½		BTS-22K	
R6	27KΩ	½		BTS-27K	
R7	220KΩ	½		BTS-220K	Note 1
R8	1Meg	½		BTS-1Meg	
R9	1500Ω	½		BTS-1500	
R10	220KΩ	½		BTS-220K	
R11	100KΩ	½		BTS-100K	
R12	100KΩ	½		BTS-100K	
R13	470KΩ	½		BTS-470K	
R14	1500Ω	½		BTS-1500	
R15	47KΩ	½		BTS-47K	
R16	22KΩ	½		BTS-22K	
R17	1.5Meg	½		BTS-1.5Meg	
R18	22KΩ	½		BTS-22K	
R19	47KΩ	½		BTS-47K	
R20	4700Ω	½		BTS-4700	
R21	47KΩ	½		BTS-47K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA KNIGHT PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R22	470KΩ	½		BTS-470K	
R23	1500Ω	½		BTS-1500	
R24	220KΩ	½		BTS-220K	
R25	22KΩ	½		BTS-22K	
R26	3000Ω 5%	½		BTS-3300 5%	
R27	270KΩ	½		BTS-270K	
R28	470KΩ	½		BTS-470K	
R29	680Ω	½		BTS-680	
R30	47KΩ	½		BTS-47K	
R31	47KΩ	½		BTS-47K	
R32	470KΩ	½		BTS-470K	
R33	350Ω	4		PW4-350	
R34	470KΩ	1½		BTS-470K	
R35	15KΩ	1½		BTS-15K	
R36	2200Ω	2		BTB-2200	
R37	4700Ω	½		BTS-4700	
R38	4700Ω	½		BTS-4700	

Note 1. Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	130VAC tap @ 117VAC @ .44A	594VCT .063ADC	5VAC @ 2A	10.4VAC @.12A SEC. 4 6.3VCT @1.45A	LP-0242-B					

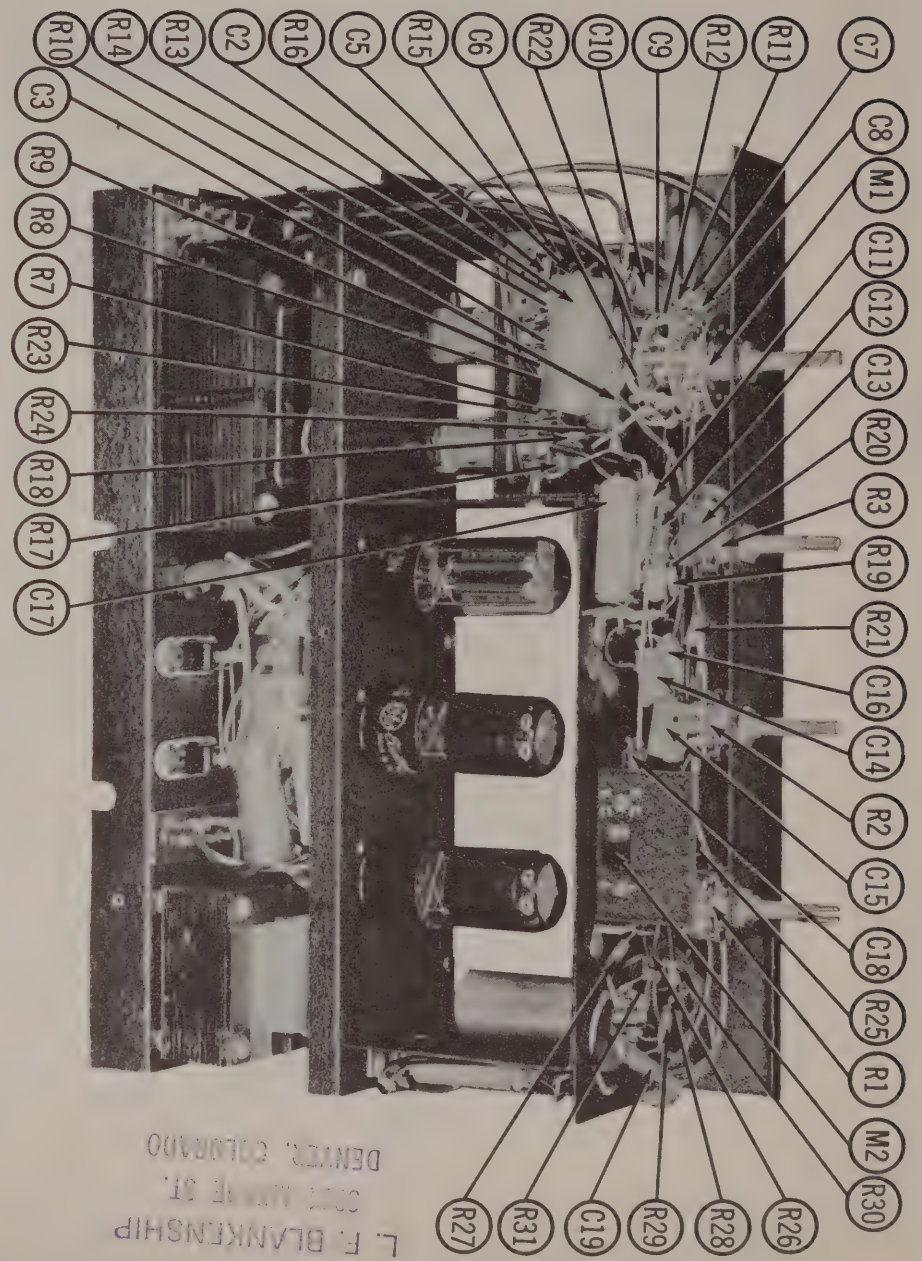
TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T2	9.6KΩ CT	16Ω tap @ 8Ω	LO-0138						

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M1	Switch		Selector & Compensator (Rotary - wafer type)
M2	Switch		Volume -Loudness (SPDT-Slide Type)

CHASSIS—BOTTOM VIEW



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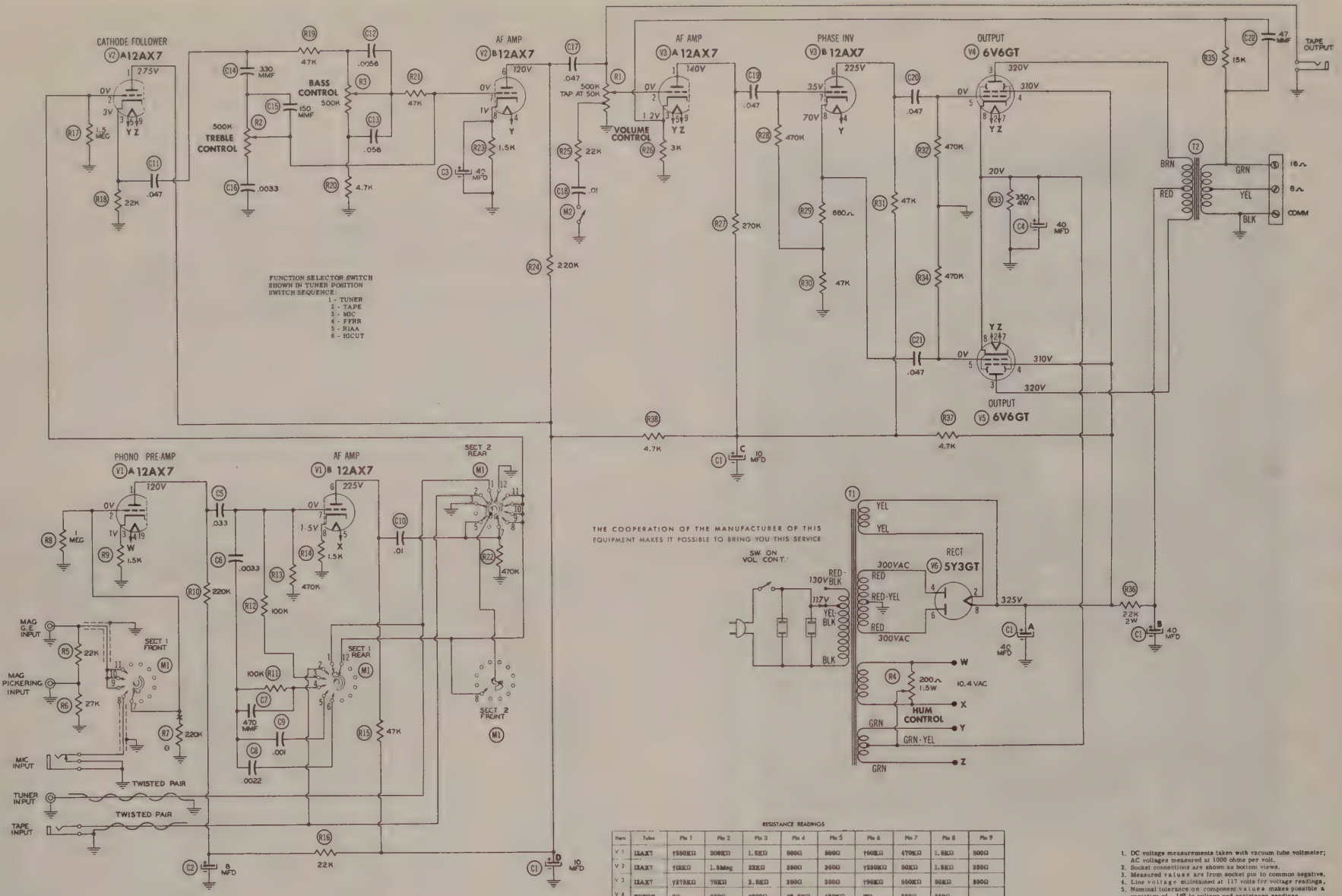
KNIGHT
MODEL 93SX312



Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AX7	†200KΩ	300KΩ	1.5KΩ	900Ω	800Ω	†90KΩ	470KΩ	1.5KΩ	500Ω
V 2	12AX7	†1MΩ	1.5Meg	22KΩ	350Ω	350Ω	†230KΩ	80KΩ	1.5KΩ	350Ω
V 3	12AX7	†275KΩ	70KΩ	2.5KΩ	350Ω	350Ω	†90KΩ	350KΩ	80KΩ	350Ω
V 4	6V6GT	0Ω	350Ω	†200Ω	†2.2KΩ	470KΩ	TP	350Ω	350Ω	
V 5	6V6GT	0Ω	350Ω	†200Ω	†2.2KΩ	470KΩ	NC	350Ω	350Ω	
V 6	5Y3GT	TP	70KΩ	TP	100Ω	TP	100Ω	NC	70KΩ	

RESISTANCE READINGS

† MEASURED FROM PIN 5 OF V6.
ALL MEASUREMENTS TAKEN WITH SELECTOR SWITCH IN TUNER POSITION
TP - TIE POINT
NC - NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 10% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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MAGNAVOX
CHASSIS AMP-135

MAGNAVOX
CHASSIS AMP-135

TRADE NAME	Magnavox Chassis AMP-135
MANUFACTURER	Magnavox Co., 2131 Bueter Rd., Fort Wayne, Ind.
TYPE SET	AC Operated 10 Watt Audio Amplifier
TUBES (Four)	Types 12AX7 AF Amp.-Phase Inv., (2) 6V6GT Output, 5Y3GT Rectifier
POWER SUPPLY	110-120 Volts AC-50/60 Cycles RATING .52 Amp. @ 117 Volts AC

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PARTS LIST AND DESCRIPTIONS

MAGNAVOX CHASSIS AMP-135

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: MAGNAVOX PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	AF Amplifier-Phase Inverter	12AX7	12AX7	9A	
V2	Audio Output	6V6GT	6V6GT	7S	
V3	Audio Output	6V6GT	6V6GT	7S	
V4	Rectifier	5Y3GT	5Y3GT	5T	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: MAGNAVOX PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1A	▲40	450	270021-56			FP429	TM-4022	Q-380	
B	■30	450							
C	▲10	450							
D	20	25							
C2	.022	200	250202-9	DF-203	817-02	PT4122	IMP6-S22	3304122	
C3	470		250207-23	D6-471	811-471				
C4	5000		250175-1	DD-502	811-005	DC-525	IMP6-D5	C-1250	
C5	.047	600	250201-11	DF-503		PT6147	IMP6-S47	3306147	
C6	.047	200	250202-11	DF-503		PT4147	IMP2-S47	3302147	
C7	.022	200	250202-9	DF-203	817-02	PT4122	IMP6-S22	3304122	
C8	1	200				PT41	CT2-1	330210	
C9	1	200				PT41	CT2-1	330210	

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: MAGNAVOX PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R1	470KΩ	½	230104-94	BTS-470K	
R2	100KΩ	½	230104-86	BTS-100K	
R3	3300Ω	½	230104-68	BTS-3300	
R4	10KΩ	½	230104-74	BTS-10K	
R5	270KΩ	½	230104-91	BTS-270K	
R6	8.2Meg	½	230104-109	BTS-8.2Meg	
R7	47KΩ	½	230104-82	BTS-47K	

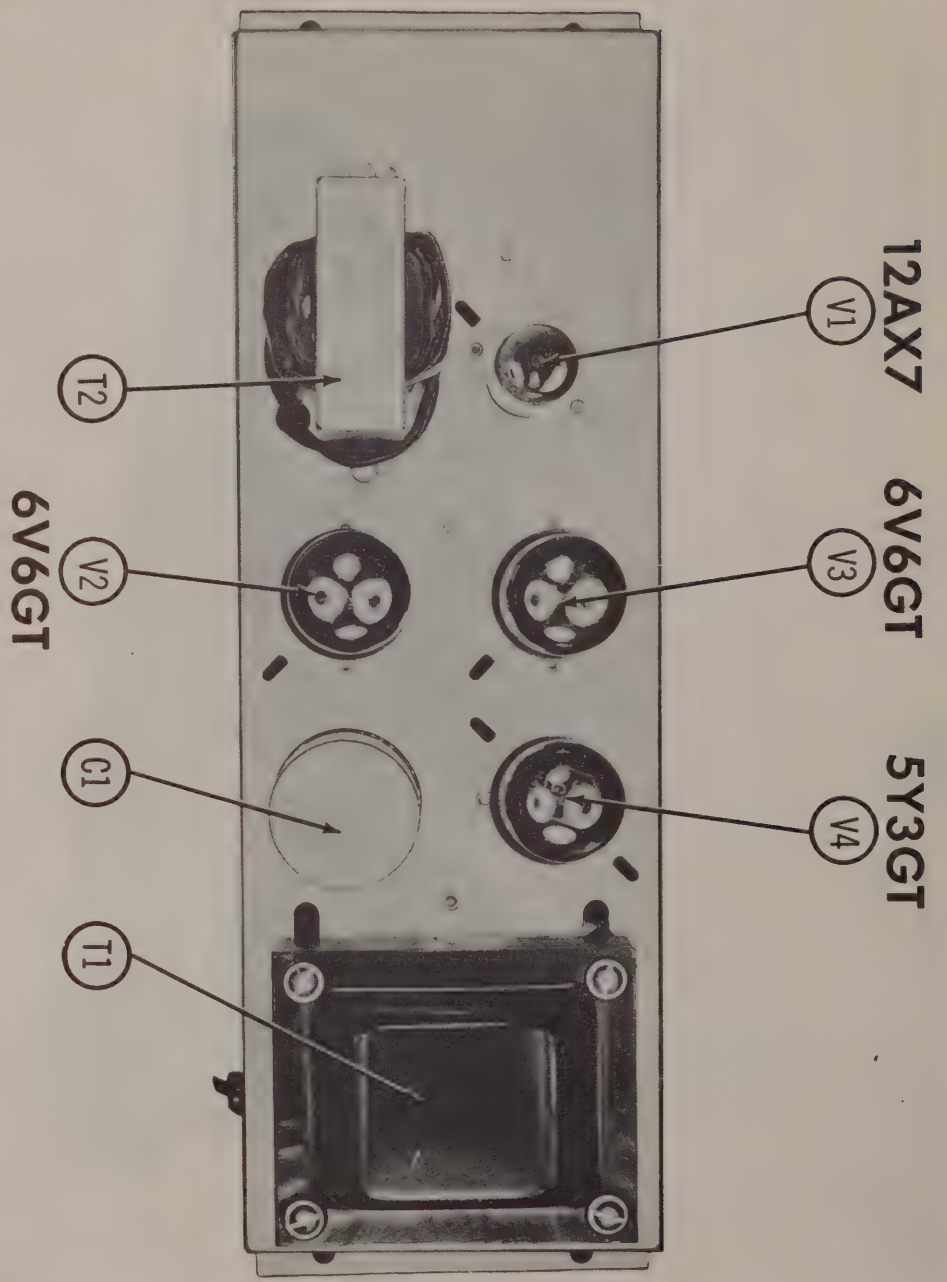
ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: MAGNAVOX PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R8	47KΩ	½	230104-82	BTS-47K	
R9	470KΩ	½	230104-94	BTS-470K	
R10	270Ω	2	230096-55		
R11	470KΩ	½	230104-94	BTS-470K	
R12	100KΩ	½	230104-86	BTS-100K	
R13	4700Ω	½	230104-70	BTS-4700	
R14	470Ω	2	230096-58	BTB-470	
R15	500Ω	10	240071-8	PW10-500	

TRANSFORMER (POWER)

ITEM No.	RATING: PRI.	RATING: SEC. 1	RATING: SEC. 2	RATING: SEC. 3	REPLACEMENT DATA: MAGNAVOX PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .52A	700VCT .072ADC	5VAC @ 2A	6.3VAC @ 1.13A	C300078-1	P9311 ①	P2952 ①	PM-8409 ①	24R04 ①	R-11B ①

① Tape 6.3V center tap.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

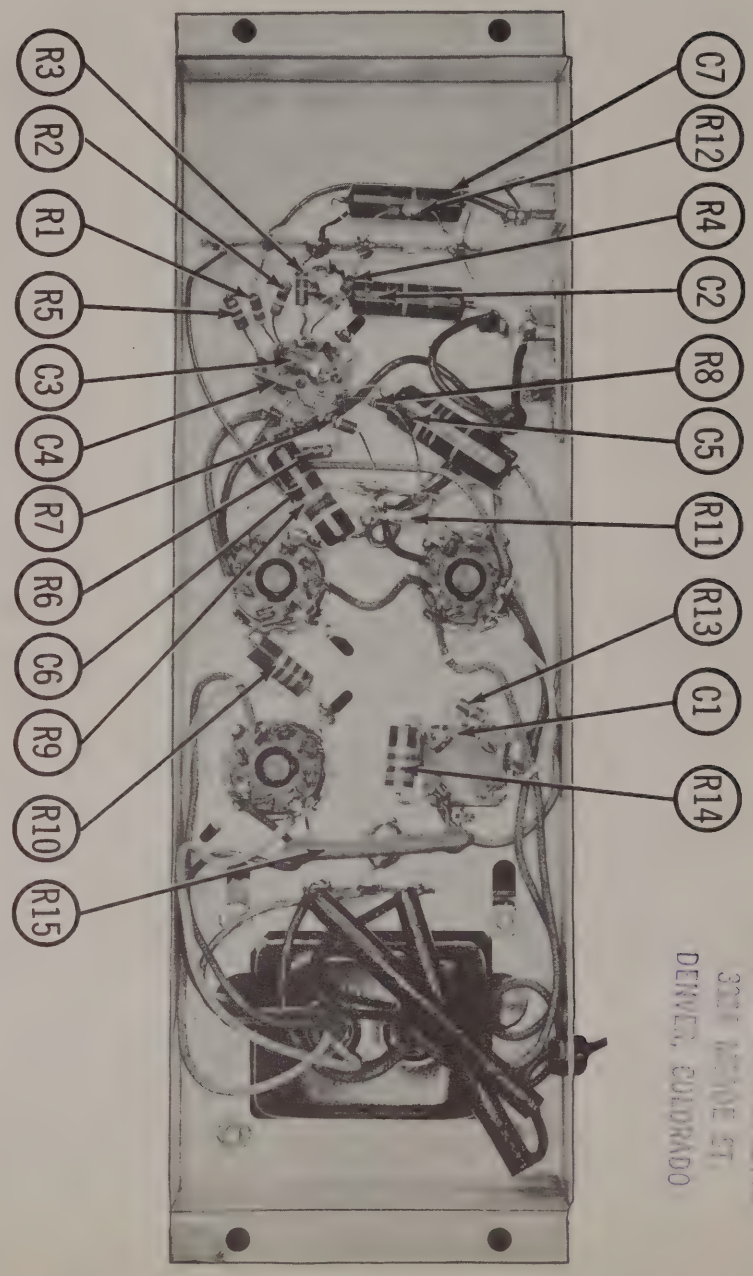
TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	MAGNAVOX PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	8.8KΩ CT	3.4Ω	CS30038-1	Z1011	A-2901①	A-3870	22S58	S-53X	① Drill one new mounting hole.

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA		NOTES
	SIZE	FIELD	V. C. IMP.	MAGNAVOX PART No.	QUAM PART No.	
SP1	5"	PM	3.4Ω	580038-1①		① Tweeter
SP2	12"	PM	3.4Ω	583684	12A10Z3.2	

CHASSIS—BOTTOM VIEW



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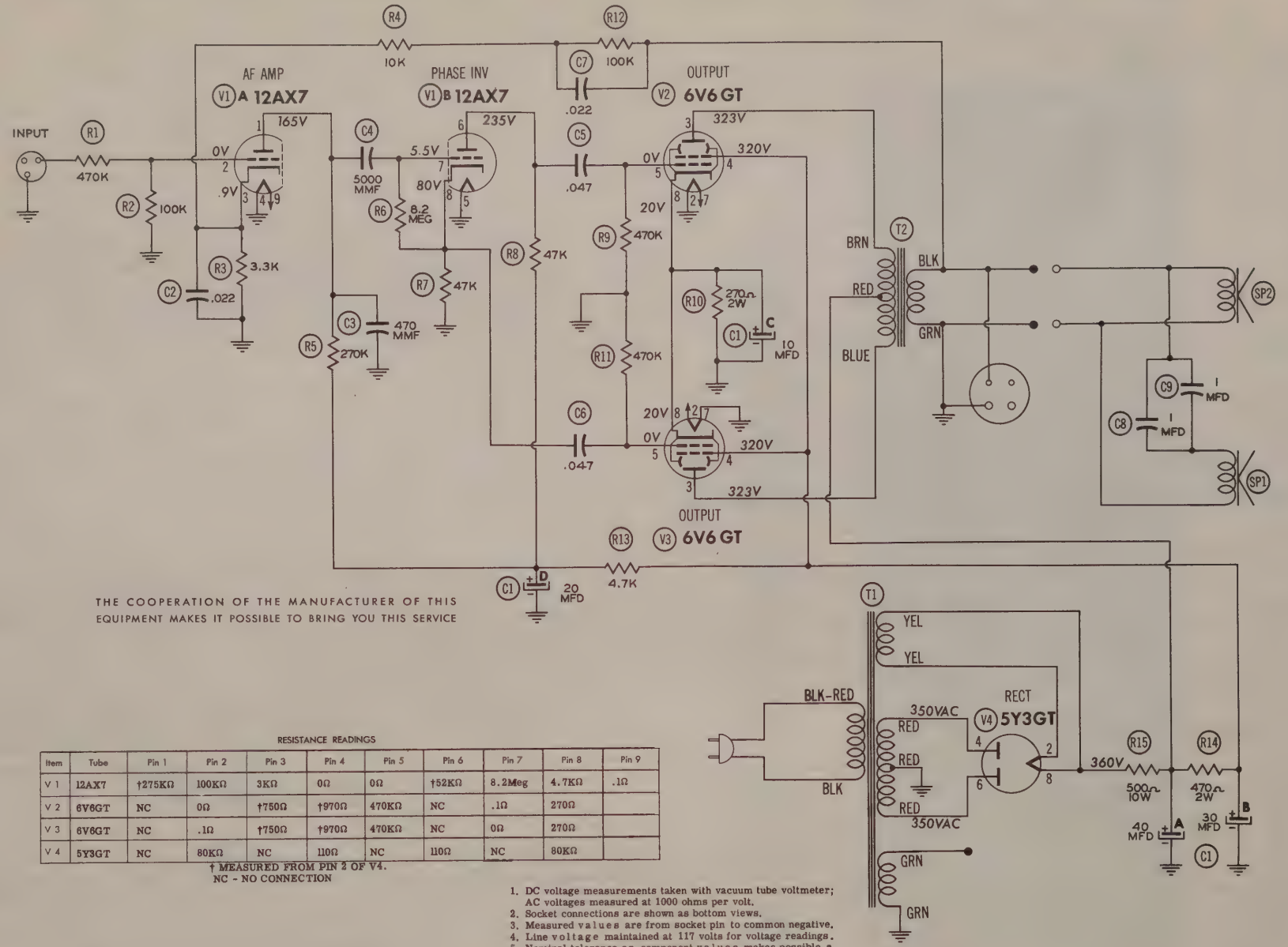

THE COOPERATION OF THE MANUFACTURER OF THIS EQUIPMENT MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AX7	†275KΩ	100KΩ	3KΩ	0Ω	0Ω	†52KΩ	8.2Meg	4.7KΩ	.1Ω
V 2	6V6GT	NC	0Ω	†750Ω	†970Ω	470KΩ	NC	.1Ω	270Ω	
V 3	6V6GT	NC	.1Ω	†750Ω	†970Ω	470KΩ	NC	0Ω	270Ω	
V 4	5Y3GT	NC	80KΩ	NC	110Ω	NC	110Ω	NC	80KΩ	

† MEASURED FROM PIN 2 OF V4.
NC - NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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288-6

PHOTOFACT* Folder

OLYMPIC MODELS 17TW27, 21CX29, 21TX28 (Ch. W, X)

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MODEL 17TW27

OLYMPIC MODELS 17TW27, 21CX29, 21TX28 (Ch. W, X)

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OLYMPIC MODELS 17TW27, 21CX29, 21TX28 (Ch. W, X)

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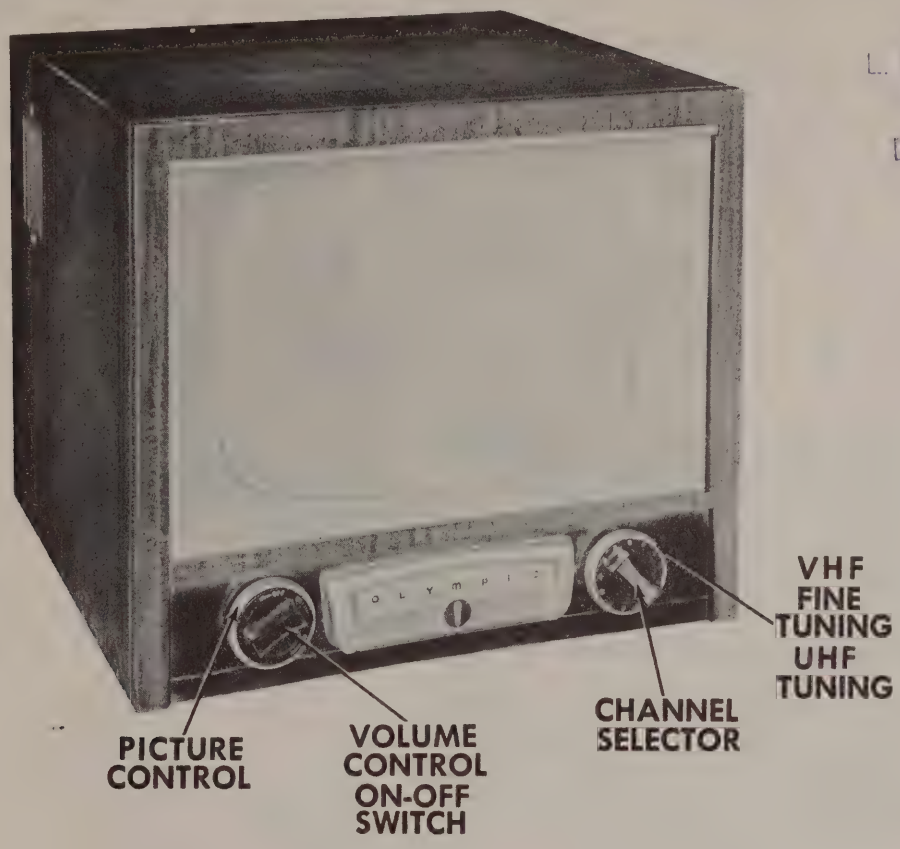

OLYMPIC MODELS 17TW27, 21CX29, 21TX28 (Ch. W, X)

OLYMPIC MODEL 17TW27

TRADE NAME	Olympic Models 17TW27 (Ch. "W"), 21CX29, 21TW28 (Ch. "X")
MANUFACTURER	Olympic Radio & Television Inc., 34-01 38th. Ave., Long Island City, 1, N.Y.
TYPE SET	Television Receiver
TUBES	Twenty
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING 1.42 Amp. @ 117 Volts AC
TUNING RANGE	Channels 2 thru 13 VHF, 14 thru 83 UHF, Video IF 45.75MC, Sound IF 41.25MC (Intercarrier)

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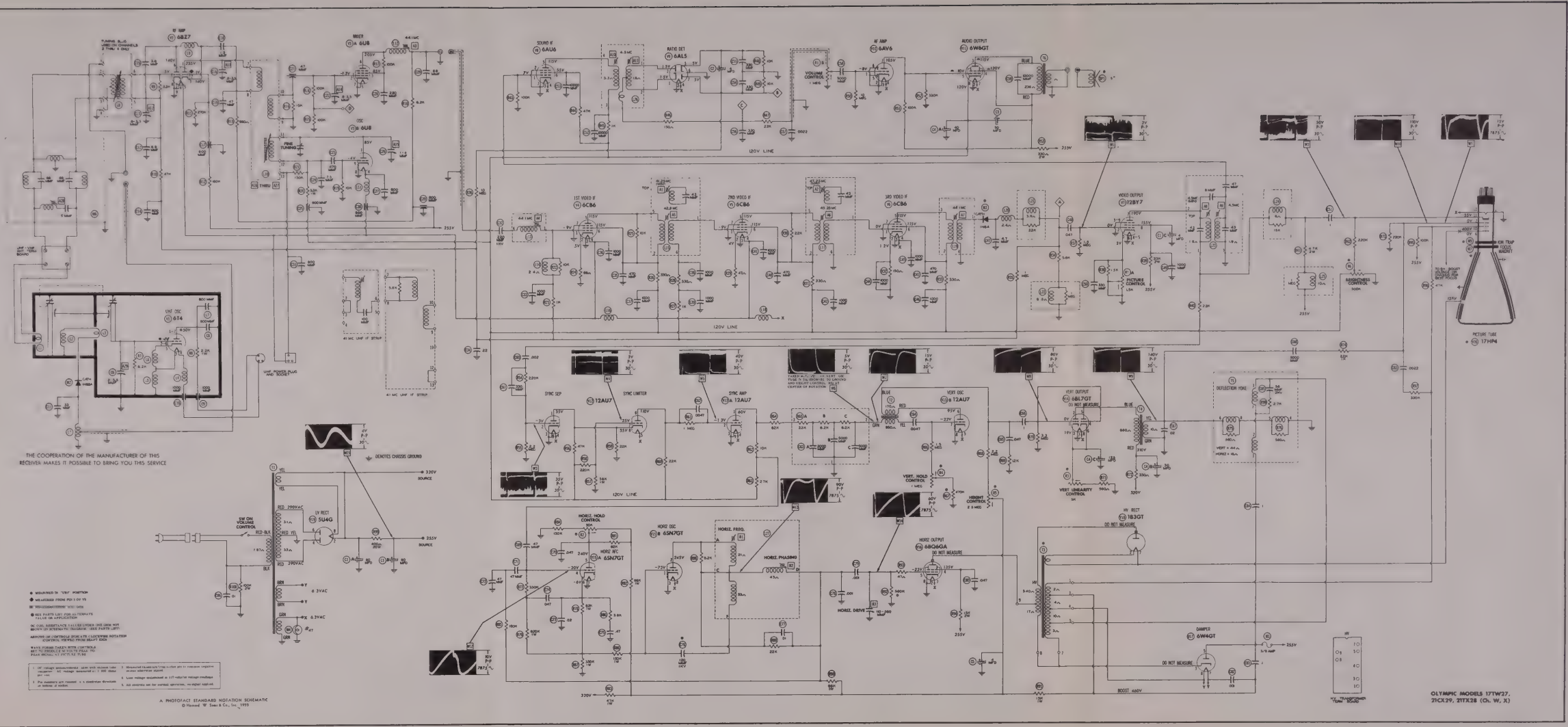

THE COOPERATION OF THE MANUFACTURER OF THIS RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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OLYMPIC MODELS 17TW27,
21CX29, 21TX28 (Ch. W, X)

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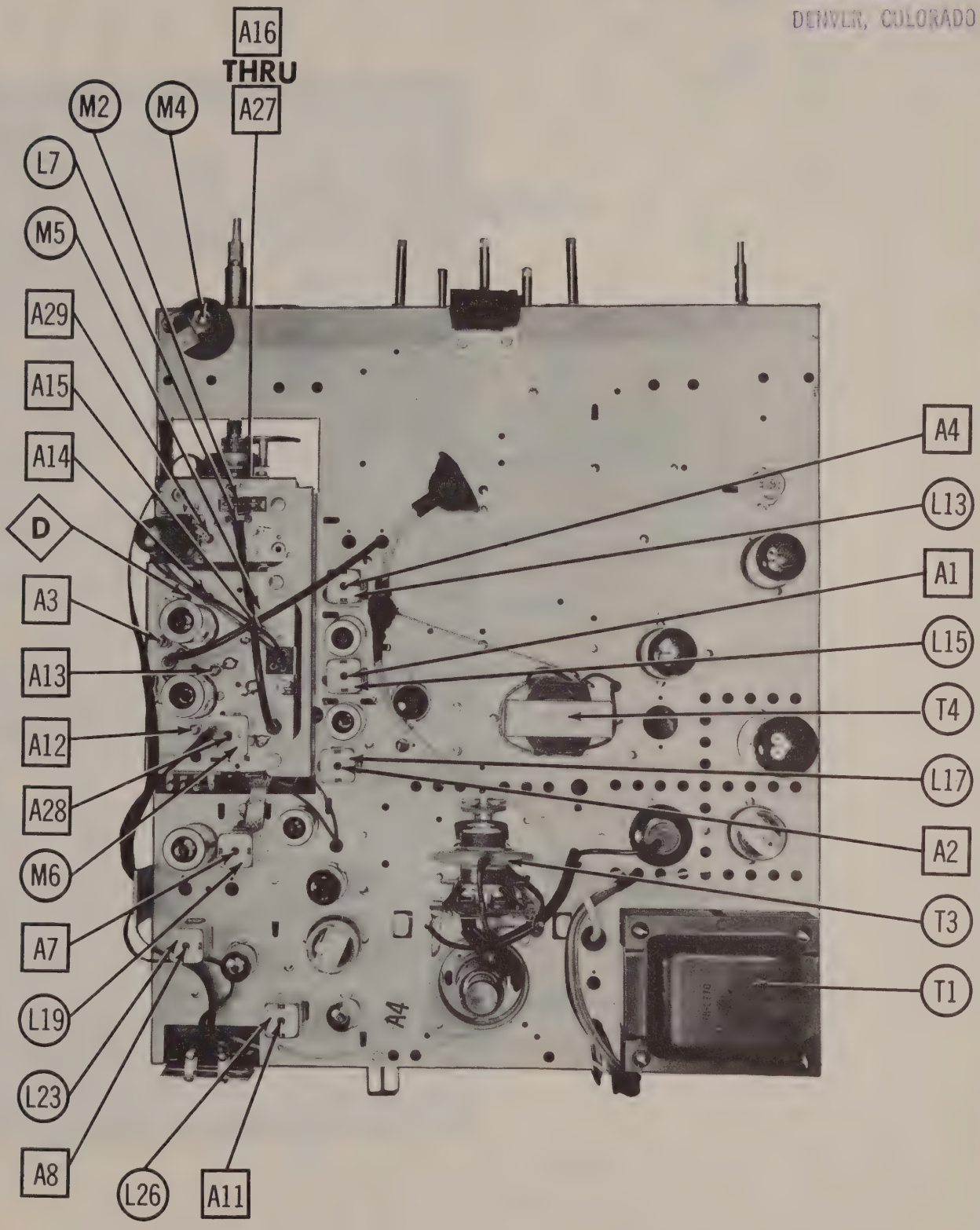
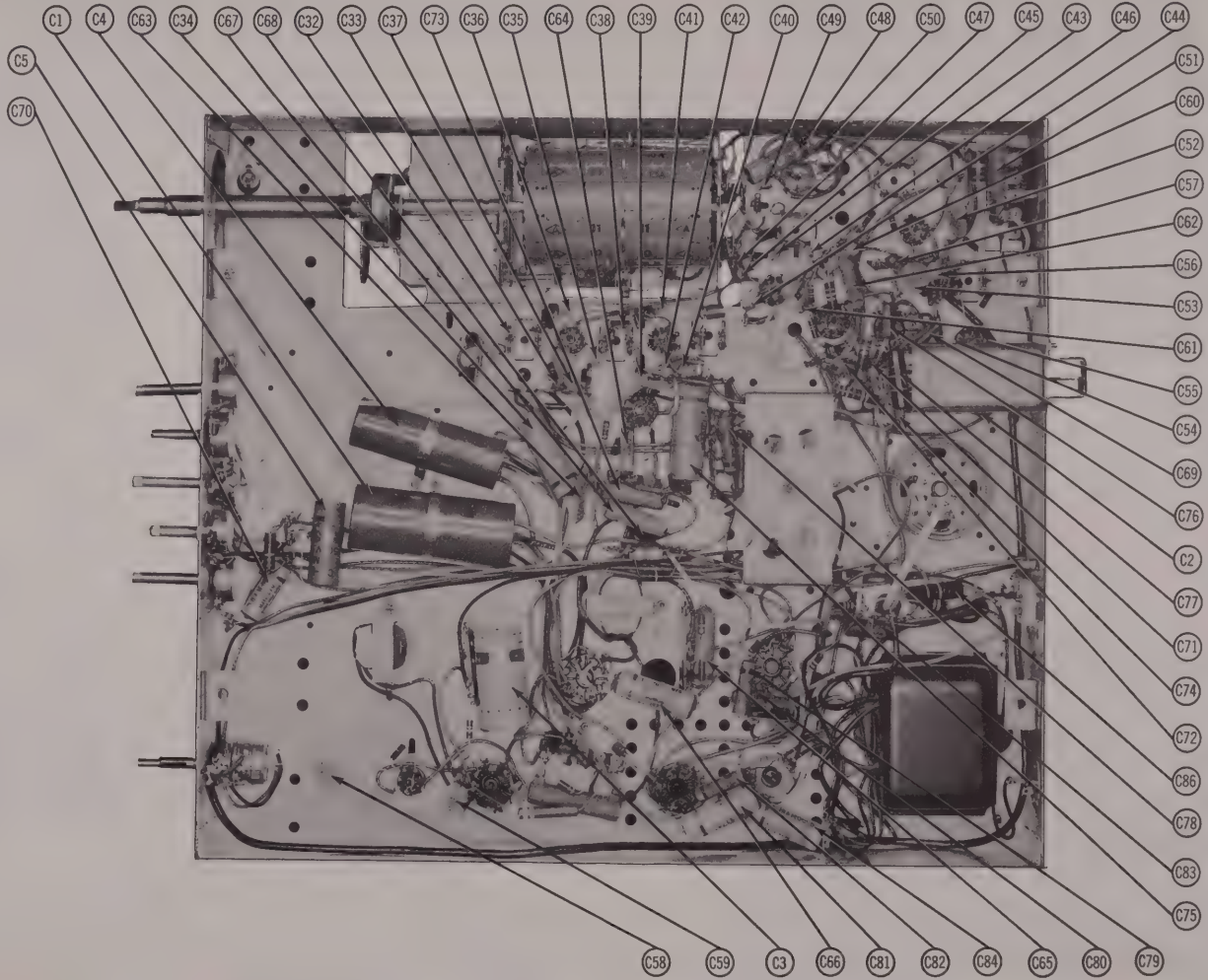
DENVER, COLORADO



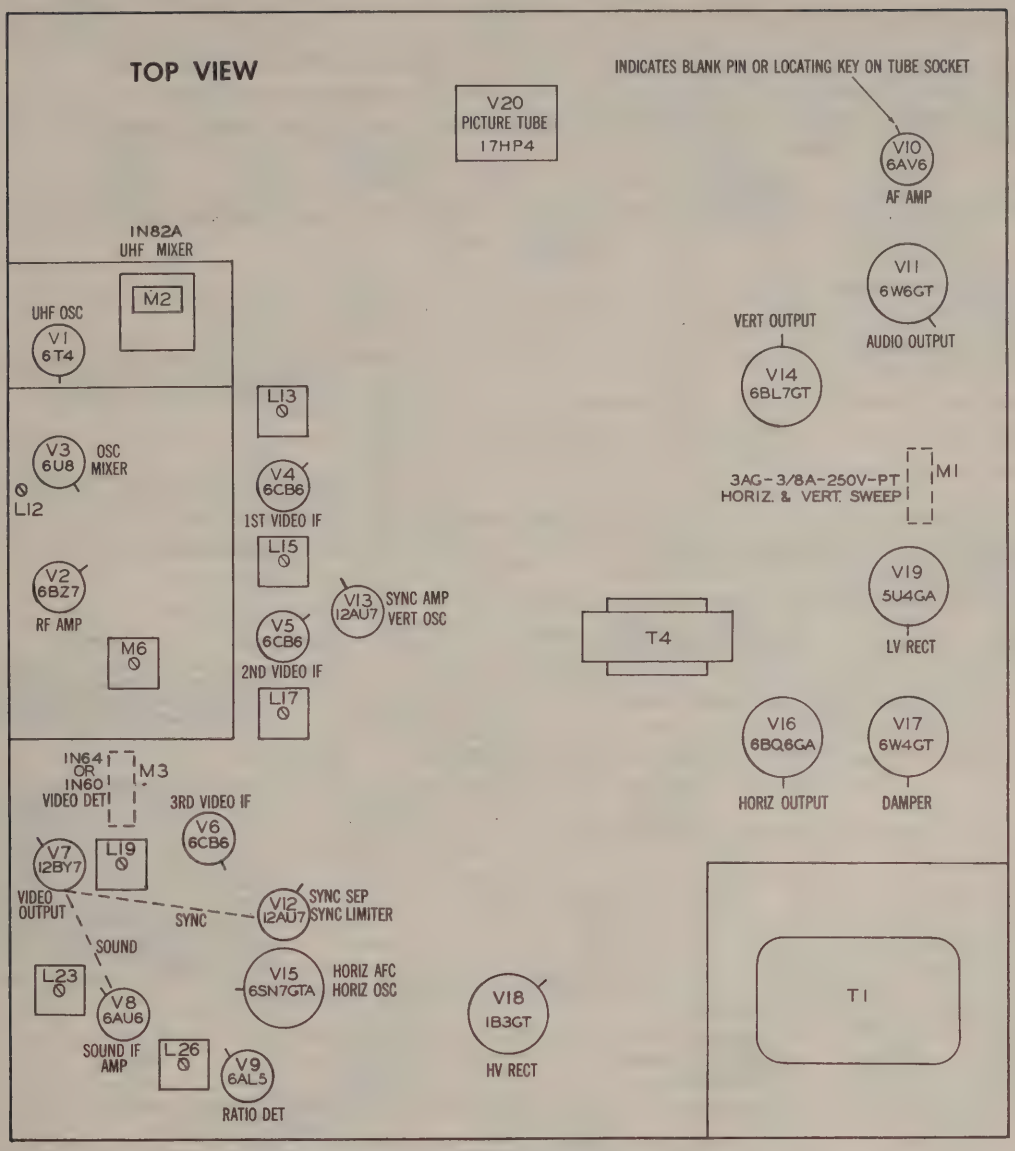
CHASSIS TOP VIEW

SET 288 FOLDER 7



CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

POWER SUPPLY FAILURE
No raster, no sound - V19

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V3, V4, V5, V6, V7, V11 (V1 UHF only)
No pic, no sound, has snow - V2, V3, V4
No pic, has sound, has raster - V7, V20
Has pic, no sound - V8, V9, V10, V11

SYNC FAILURE
No vert. sync - V13
No horiz. sync - V13, V15
No vert. or horiz. sync - V12, V13

SWEEP FAILURE
No raster, has sound - V15, V16, V17, V18, V20, Fuse (M1)
No vertical deflection - V13, V14
Poor vert. linearity or foldover - V13, V14
Poor horiz. linearity or foldover - V15, V16, V17
Narrow picture - V15, V16, V17, V18, V19
Vert. off freq. - V13
Horiz. off freq. - V13, V15

PROPERTY OF

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage lead should be securely taped and kept away from chassis. Do not remove the horizontal oscillator tube to eliminate the high voltage shock hazard.

VIDEO IF ALIGNMENT

Remove the converter tube from its socket and replace with a 6U8 which has pin 1 removed. This will disable the local oscillator and reduce the possibility of erroneous indications.
An alternate method of disabling the local oscillator is to place a piece of transparent cellulose tape on first two contacts (from front of drum assembly) of any channel strip and then switching to that channel.
Use only enough generator output for usable indication on VTVM. Connect the negative lead of 1.5 volt bias supply to the ungrounded side of C34. Positive lead to chassis.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
1.	Direct	High side to an ungrounded tube shield floating over dummy converter tube. Low side to chassis.	41.25MC (Unmod)	Any	DC probe thru 10KΩ to point Ⓐ. Common to chassis.	A1	Adjust for MINIMUM deflection.
2.	"	"	47.25MC	"	"	A2	"
3.	"	"	44.1MC	"	"	A3, A4	Adjust for maximum deflection. If oscillation occurs during alignment, preset A7 counter clockwise until screw projects approximately 3/4 inch.
4.	"	"	42.9MC	"	"	A5	"
5.	"	"	45.25MC	"	"	A6	"
6.	"	"	44.1MC	"	"	A7	Adjust for maximum deflection. Remove VTVM from point Ⓐ.

OVERALL VIDEO IF RESPONSE CHECK

Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
Connect the negative lead of a 1.5 volt bias supply to the ungrounded side of C34.
Connect positive lead to chassis.
Use only enough sweep generator output to produce usable pattern on scope.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
7.	Direct	High side to an ungrounded tube shield floating over a dummy converter tube. Low side to chassis.	43.5MC (10MC Swp)	42.5MC 45.7MC	Any	Vert. Amp. thru detector (Fig. 1) to pin 1 (grid) of 6CB6 (V5). Low side to chassis.		Check for response similar to Fig. 2. If necessary retouch A3 and A4 for desired response and proper marker position.
8.	"	"	"	41.25MC 42.5MC 45.75MC 47.25MC	"	Vert. Amp. thru 100KΩ to point Ⓐ. Low side to chassis.		Check for response similar to Fig. 3. If necessary retouch A5, A6 and A7 for desired response. Do not readjust A3 and A4. Retouch A1 and A2 for proper 41.25MC and 47.25MC trap marker positions. A5 affects low frequency side of curve (42.5MC), A6 affects high frequency side (45.75MC) and A7 affects tilt of response curve. Remove dummy converter tube and replace original 6U8 in its socket or remove cellulose tape. Replace shield over converter tube. Remove bias from C34.

4.5MC TRAP ALIGNMENT

Remove the 3rd. IF tube (V6) from its socket.
Set contrast control for maximum.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
9.	.01MFD	High side to point Ⓐ. Low side to chassis.	4.5MC (Unmod)	Any	DC probe thru detector (Fig. 4) to pin 11 cathode of picture tube. Common to chassis.	A8	Adjust for MINIMUM deflection. Replace V6 in its socket.

ALTERNATE 4.5MC TRAP ALIGNMENT

Tune in a local TV station. Set fine tuning control to bring in a fine herringbone sound beat in the picture. Adjust A8 for minimum 4.5MC beat in the picture.

SOUND IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Remove 6CB6 (V6) from its socket.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
10.	.01MFD	High side to point Ⓐ. Low side to chassis.	4.5MC (Unmod)	Any	DC probe to point Ⓑ. Common to chassis.	A9, A10	Adjust for maximum deflection.
11.	"	"	"	"	DC probe to point Ⓒ. Common to chassis.	A-11	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting. Replace V6 in its socket.

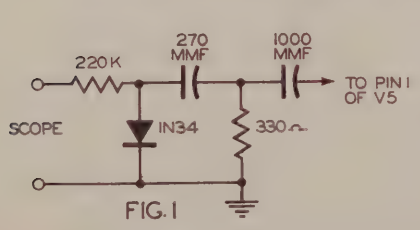


FIG. 1

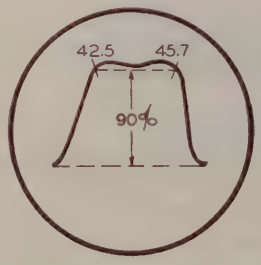


FIG. 2

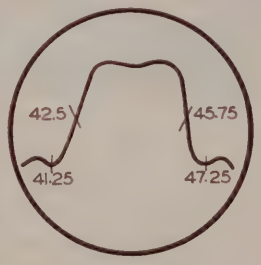


FIG. 3

ALIGNMENT INSTRUCTIONS (cont)

PROPERTY OF
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ALTERNATE SOUND IF ALIGNMENT USING ON THE AIR SIGNAL

Replace original 6U8 in its socket, if not previously replaced.
Tune the receiver to a TV station, and adjust fine tuning control for best picture.
Connect DC probe of VTVM to point Ⓑ . Common lead to chassis. Adjust A9 and A10 for maximum deflection. Then connect DC probe of VTVM to point Ⓒ . Common lead to chassis. Adjust A-11 for a zero reading. A positive and negative reading will be obtained on either side of the correct setting of A-11.

VHF RF AND MIXER ALIGNMENT

Connect a jumper from the ungrounded side of C34 and chassis.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
12.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	207MC (10MC Swp)	205.25MC 209.75MC	12	Vert. Amp. thru 10KΩ to point Ⓓ . Low side to tuner chassis.	A12, A13, A14	Adjust for response curve similar to Fig. 5 with markers above 90%.
13.	"	"	213MC (10MC Swp)	211.25MC 215.75MC	13	"		If markers fall below 70% on any channel make compromise adjustment of A12, A13 and A14 with channel switch set to that channel, then check all other channels to see that they have not been seriously affected. Remove clip lead from C34 and chassis.
			201MC (10MC Swp)	199.25MC 203.75MC	11			
			195MC (10MC Swp)	193.25MC 197.75MC	10			
			189MC (10MC Swp)	187.25MC 191.75MC	9			
			183MC (10MC Swp)	181.25MC 185.75MC	8			
			177MC (10MC Swp)	175.25MC 179.75MC	7			
			85MC (10MC Swp)	83.25MC 87.75MC	6			
			79MC (10MC Swp)	77.25MC 81.75MC	5			
			69MC (10MC Swp)	67.25MC 71.75MC	4			
			63MC (10MC Swp)	61.25MC 65.75MC	3			
			57MC (10MC Swp)	55.25MC 59.75MC	2			

VHF OSCILLATOR ALIGNMENT

Complete oscillator alignment may not be necessary.
If the oscillator seems to be off frequency approximately the same amount for a majority of the channels it may be possible to correct them in one step using A15.
It should be noted that this is an all channel oscillator circuit adjustment and should not be used to correct any individual channel. If adjustment of A15 will not bring all channels well within range of the fine tuning control it will be necessary to adjust the channel strip adjustment for each channel that is off frequency.
The channel oscillator adjustment screws are reached thru a hole just above the channel switch shaft. The correct adjustment screw is accessible thru this hole as the channel switch is turned to each channel.
Connect the bias as under "Video IF Alignment".
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
14.	Two 120Ω Carbon Resistors	Across VHF antenna terminal with 120Ω in each lead.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. Amp. thru 47KΩ to point Ⓐ . Low side to chassis.	A16	Adjust to place sound marker in trap notch as in Fig. 6. Video marker should be at 50%.
			207MC (10MC Swp)	205.25MC 209.75MC	12		A17	
			201MC (10MC Swp)	199.25MC 203.75MC	11		A18	
			195MC (10MC Swp)	193.25MC 197.75MC	10		A19	
			189MC (10MC Swp)	187.25MC 191.75MC	9		A20	
			183MC (10MC Swp)	181.25MC 185.75MC	8		A21	
			177MC (10MC Swp)	175.25MC 179.75MC	7		A22	
			85MC (10MC Swp)	83.25MC 87.75MC	6		A23	
			79MC (10MC Swp)	77.25MC 81.75MC	5		A24	
			69MC (10MC Swp)	67.25MC 71.75MC	4		A25	
			63MC (10MC Swp)	61.25MC 65.75MC	3		A26	
			57MC (10MC Swp)	55.25MC 59.75MC	2		A27	

40MC TRAP ALIGNMENT

The 40MC trap (A28) will require adjustment only where a local interfering signal from 40MC thru 45MC affects the picture. In such cases A28 should be adjusted for minimum 40MC beat interference in the picture.

UHF TUNER ALIGNMENT

The UHF tuner has been properly aligned at the factory and is very stable. Adjustment should not be attempted in the field unless absolutely necessary.
Tune in a local UHF station operating in that area. Be sure all UHF station numbers pass beneath the cursor line on tuning dial indicator.
With UHF station in that area tuned in and its station number under the cursor line, adjust A29 for best picture and sound.

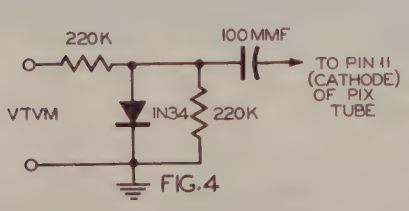


FIG. 4

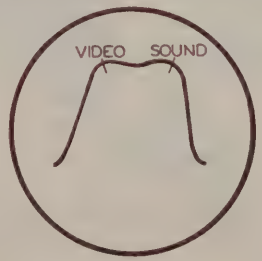


FIG. 5

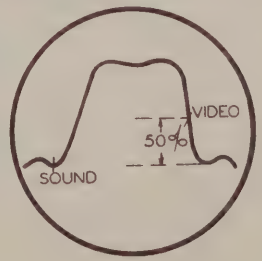
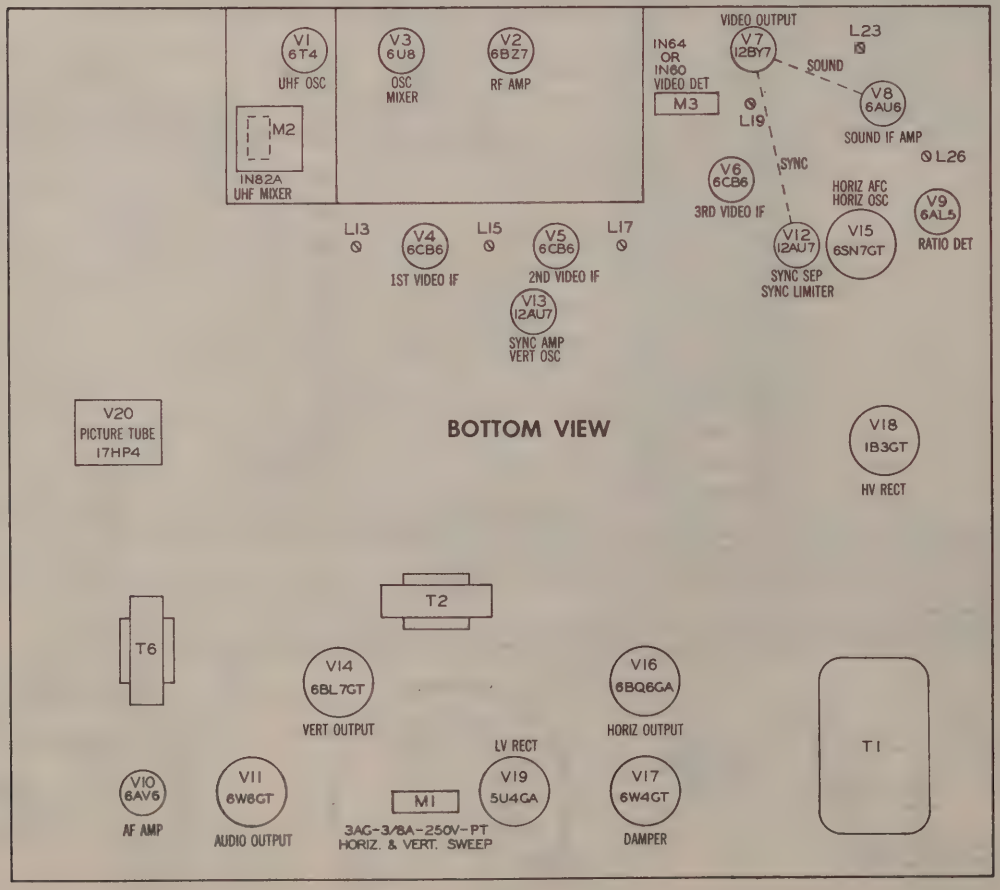


FIG. 6

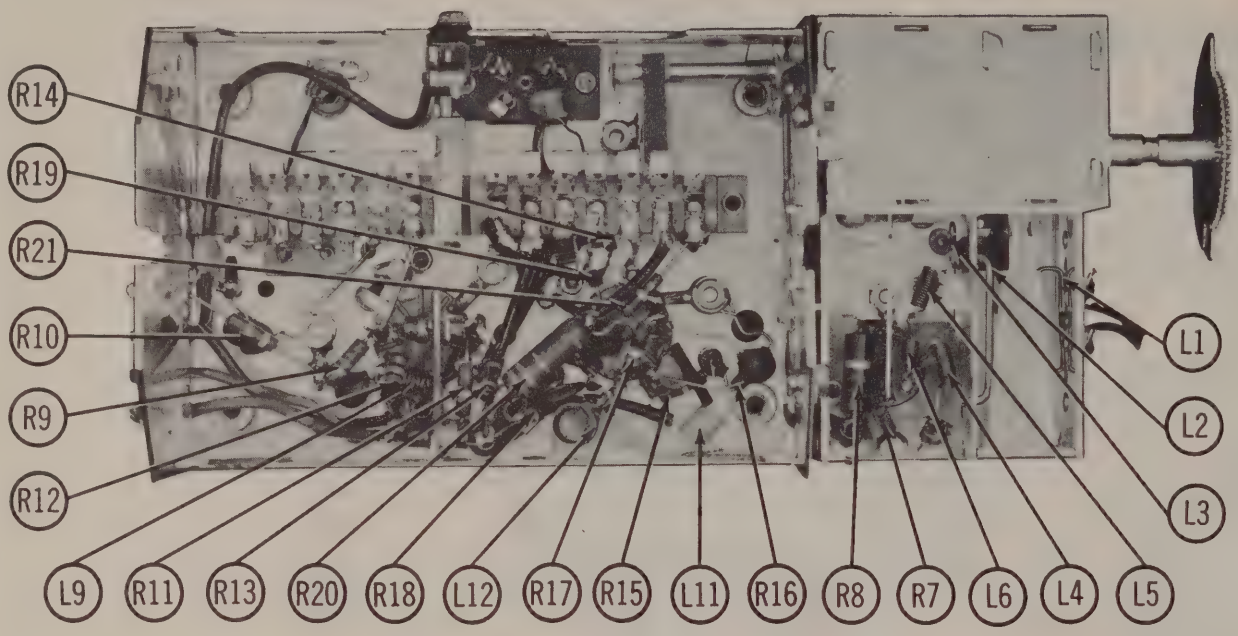
RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6T4	*■5.5KΩ	8.2KΩ	0Ω	.1Ω	0Ω	8.2KΩ	*■5.5KΩ		
V 2	6BZ7	†1.1KΩ	140KΩ	INF	0Ω	.1Ω	INF	1Meg	0Ω	0Ω
V 3	6U8	■3.3KΩ	200KΩ	†100KΩ	.1Ω	0Ω	†8.2KΩ	0Ω	0Ω	10KΩ
V 4	6CB6	1Meg	68Ω	0Ω	.1Ω	■330Ω	■330Ω	0Ω		
V 5	6CB6	1Meg	47Ω	0Ω	.1Ω	■330Ω	■330Ω	0Ω		
V 6	6CB6	.2Ω	150Ω	0Ω	.1Ω	■330Ω	■330Ω	0Ω		
V 7	12BY7	200Ω	1.5Meg	0Ω	.1Ω	.1Ω	0Ω	†5.1KΩ	†33KΩ	0Ω
V 8	6AU6	100KΩ	0Ω	0Ω	.1Ω	■1KΩ	■47KΩ	0Ω		
V 9	6AL5	1Meg	1Meg	0Ω	.1Ω	10KΩ	0Ω	10KΩ		
V 10	6AV6	10Meg	0Ω	0Ω	.1Ω	0Ω	0Ω	†100KΩ		
V 11	6W6GT	0Ω	0Ω	†1KΩ	†800Ω	120KΩ	NC	.1Ω	50KΩ	
V 12	12AU7	■40KΩ	2.2Meg	0Ω	.1Ω	.1Ω	■22KΩ	■80KΩ	■40KΩ	0Ω
V 13	12AU7	■13KΩ	1Meg	0Ω	.1Ω	.1Ω	▲3Meg	2Meg	0Ω	0Ω
V 14	6BL7GT	3.3Meg	†1KΩ	1.1KΩ	3.3Meg	†1KΩ	1.1KΩ	0Ω	.1Ω	
V 15	6SN7GT	500KΩ	▲90KΩ	0Ω	1.5Meg	†90KΩ	420KΩ	0Ω	.1Ω	
V 16	6BQ6GA	TP	0Ω	TP	†16KΩ	560KΩ	TP	.1Ω	0Ω	TOP CAP ▲17Ω
V 17	6W4GT	NC	NC	100KΩ	NC	†400Ω	NC	100KΩ	100KΩ	
V 18	1B3GT		PINS	1 - 8	HAVE	INF	RESISTANCE			TOP CAP ▲560Ω
V 19	5U4GA	NC	70KΩ	TP	31Ω	TP	33Ω	NC	70KΩ	
V 20	17HP4	0Ω	220KΩ	PIN 8 0Ω	PIN 10 ▲47KΩ	PIN 11 ■260KΩ	PIN 12 .1Ω			

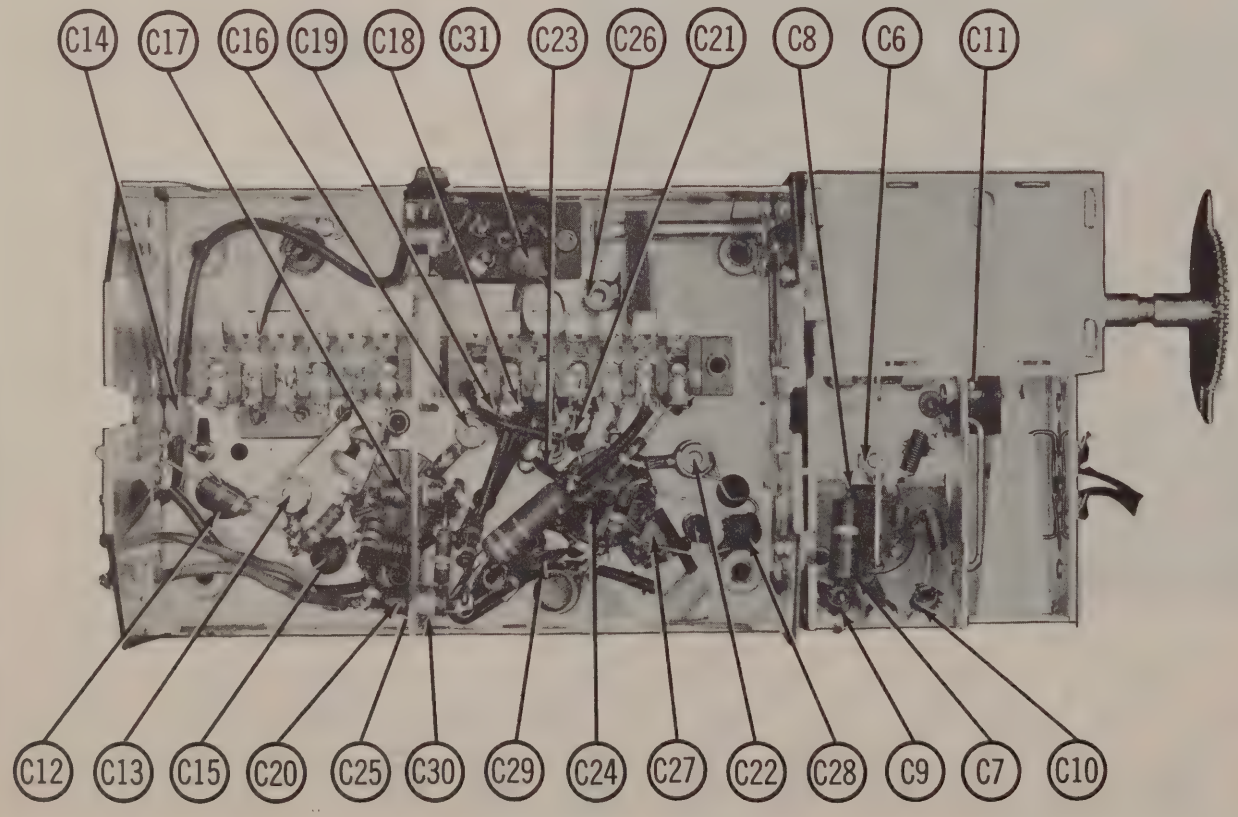
* MEASURED IN "UHF" POSITION
■ MEASURED FROM 120V LINE
† MEASURED FROM PIN 2 OF V19
▲ MEASURED FROM PIN 3 OF V17
TP - TIE POINT
NC - NO CONNECTION



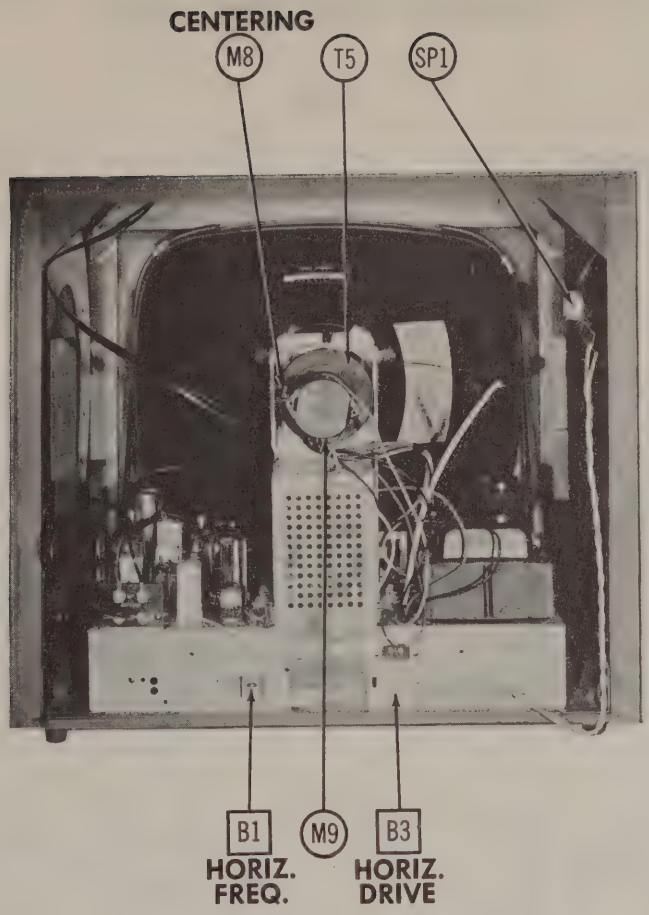
TUBE PLACEMENT CHART



UHF-VHF TUNER BOTTOM VIEW CAPACITOR IDENTIFICATION



UHF-VHF TUNER BOTTOM VIEW RESISTOR & INDUCTOR IDENTIFICATION



PROPERTY OF
L. F.
3929
DENVER, COLORADO

CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern.

Connect a short across terminals "C" and "D" of the horizontal oscillator coil (L27).

Set the horizontal hold control to its fully clockwise position.

Adjust the horizontal frequency slug (B1) until the picture falls into sync.

Remove the short from the horizontal oscillator coil and connect the vertical amplifier input of an oscilloscope thru a 5MMF capacitor to terminal "C" of L27.

Adjust the horizontal phasing slug (B2) for a wave shape on scope as in Fig. 7 with broad and narrow peaks of equal height.

If necessary, during adjustment of B2 keep the picture in sync with B1 or the horizontal hold control.

Remove the scope from terminal "C" of L27 and retouch B1 for the following conditions:

1. At full clockwise position of the horizontal hold control a blanking bar or picture jutter should be evident.
2. At full counter clockwise position the picture should stay in sync, or just be at the point of losing sync. Set horizontal hold control at a position that when switching off channel and back picture falls into horizontal sync.

Adjust the horizontal drive trimmer (B3) counter clockwise as far as possible without the presence of vertical white bars or compression of the picture. If it was necessary to adjust B3, recheck adjustments of B1 and B2 for proper range of the horizontal hold control.

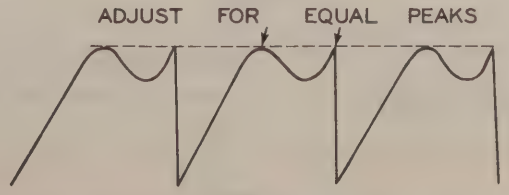


FIG. 7

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage".

INSUFFICIENT SWEEP

Check by substitution V16, V17 and V19. Check adjustment B3. Check T3, T5A, R94, R95, C79, C78 and other associated components.

DRIVE LINES

Check by substitution V16 and V17. Check adjustment B3. Check C77, C78, C 79, R94, R95, T3, T5A and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V16 and V17. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines".

PIE CRUST EFFECT

Check by substitution V15, V16 and V17. Check R80, C73, C75 for open. Check L27, R88, R2, C76 and other associated components.

XMAS TREE EFFECT

Check by substitution V15, V16 and V17. Check T3 and T5 for internal arcing. Check L27, C74, C70, C71, R85, R81 and other associated components.

VERTICAL

LOSS OF SWEEP

Check by substitution V13 and V14. Check waveform W8.

If Satisfactory	If Unsatisfactory
Check T4, C67, C4B, R72, R71 and other associated components.	Check T2, C64, C66, R5, R68, R66, and other associated components.

INSUFFICIENT SWEEP

Check by substitution V13 and V14. Check height and vertical linearity controls for proper operation. Check R68, T4 and other associated components.

COMPRESSED AT BOTTOM

Check by substitution V13 and V14. Check R5, R68, C64, C66, T2 and other associated components.

COMPRESSED AT TOP

Check by substitution V13 and V14. Check R71, R3, C4C, C4B, T4 and other associated components.

FOLDS

Check by substitution V13 and V14. Check C65, C66, T2, T4, R69 and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Check by substitution V12 and V13. Check C60, C61, C62, R56, R59, R60, R62, R63 and other associated components.

LOSS OF VERTICAL SYNC-HORIZONTAL SYNC SATISFACTORY

Substitute V13. Check vertical integrator network. Check T2, C64, R66, R67 and other associated components.

LOSS OF HORIZONTAL SYNC-VERTICAL SYNC SATISFACTORY

Substitute V15. Check C69, C72, C71, C73, C76, L27, R88 and other associated components.

HORIZONTAL BENDING

Check by substitution V12, V13 and V15. Check components associated with V15.

VIDEO

LOSS OF VIDEO

Substitute V7. Check C48, C51, R41, R39, R38 and other associated components.

SOUND BARS(4.5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check adjustment A8. Check video IF alignment.

POOR CONTRAST

Substitute V7. Check contrast control. Check L24, L25, C48, C51, R39, R41 and other associated components.

NEGATIVE PICTURE

Substitute V7. Check picture tube. Check C48, C51, L24, L25 and other associated components.

SMEAR

Substitute V7. Check L20, L21, L24, L25, C48, C51 and other associated components.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V2, V4, V5, V6, and V7 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V8, V9, V10 and V11. Check stages V10 and V11 using audio signal generator. Apply audio signal across R1B.

If Satisfactory	If Unsatisfactory
Check ratio detector and audio IF stages for component failure or change of value.	Check C58, C59, C3, C4A, R51, R53, T6, speaker and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustment A-11 for minimum buzz. If still unsatisfactory, check Audio IF alignment.

DISTORTED

Follow procedure outlined under "Weak or no Sound".

POWER

DEAD SET

If filaments fail to light, check AC interlock assembly. Check switch on volume control and T1. If filaments light, substitute V19. Check B+ filter and decoupling network.

SMALL AND/OR DIM PICTURE

Substitute V19. Check B+ filter and decoupling network.

PROPERTY OF
L. F. BLANKENSHIP
3044 MEADE ST.
DENVER, COLORADO

CHASSIS BOTTOM VIEW-TRANS., INDUCTOR AND ALIGNMENT IDENTIFICATION

OLYMPIC MODELS 17TW27, 21CX29, 21TX28 (Ch. W, X)

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: OLYMPIC PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	UHF Oscillator	6T4	6T4	7DK	
V2	RF Amplifier	6BZ7	6BZ7	9AJ	
V3	VHF Mixer-Osc.	6U8	6U8	9AE	
V4	1st. Video IF Amp.	6CB6	6CB6	7CM	
V5	2nd. Vidio IF Amp.	6CB6	6CB6	7CM	
V6	3rd. Video IF Amp.	6CB6	6CB6	7CM	
V7	Video Output	12BY7	12BY7	9BF	
V8	Sound IF Amp.	6AU6	6AU6	7BK	
V9	Ratio Det.	6AL5	6AL5	6BT	
V10	AF Amplifier	6AV6	6AV6	7BT	
V11	Audio Output	6W6GT	6W6GT	7S	
V12	Sync Sep.-Sync Limiter	12AU7	12AU7	9A	
V13	Sync Amp.-Vert. Osc.	12AU7	12AU7	9A	
V14	Vert. Output	6BL7GT	6BL7GT	8BD	
V15	Horiz. AFC-Horiz. Osc.	6SN7GT	6SN7GT	8BD	
V16	Horiz. Output	6BQ6GA	6BQ6GA	6AM	
V17	Damper	6W4GT	6W4GT	4CG	
V18	HV Rectifier	1B3GT	1B3GT	3C	
V19	LV Rectifier	5U4GA	5U4GA	5T	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA: OLYMPIC PART No.	CBS PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.	RETMA BASE TYPE	NOTES
V20	17HP4	17HP4/17RP4	17RP4/17HP4	17HP4/17RP4 17HP4B ③	17HP4/17RP4	12L	① Aluminized ② Circuit changes necessary. ③ Silver screen
	21ZP4B ①	21ZP4B ① 21ZP4A	21ZP4B ① 21ZP4A	21ZP4B ③ 21ZP4A 21ZP4 ②	21ZP4B ① 21ZP4A	12L 12N 12N	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: OLYMPIC PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C1A	60	350	CO-3380			FP242.5	TM-D60-400	D-190	
B	60	350				TC60	TD-4-450	FM-4504	
C	4	350							
C2	4	50	CO-2756			TC30	TD-4-50	MT-1504	
C3	50	250	CO-2068			TC59	TD-50-450	FM-2540	
C4A	40	200	CO-3381					MTD-4540	
B	30	350						MTH-2510	
C	125	25							
C5	4	450	CO-1056			TC70	TD-4-450	FM-4504	
C6	2-5.5			829-6		CT252			
C7	800			DD-801	801-801	DC-521			
C8	800			DD-801	801-801	DC-521			
C9	1000			MFT-1000					
C10	1000			MFT-1000					
C11	33			TCN-33	N750K-330	NT-5433			
C12	6.8			TCZ-6R8	NP0A-6R8	ZT-5568			
C13	.8-3.5								
C14	800			DD-801	801-801	DC-521			
C15	3.6			TCZ-3R3	NP0A-3R3	ZT-5533			
C16	.8-3.5								
C17	800								
C18	1.5			TCZ-1R5	NP0A-1R5	ZT-5515			
C19	47			DD-470	831-470	UC-5447			
C20	800								
C21	47			MFT-50					
C22	.8-3.5								
C23	470			DD-471	831-471	UC-5347			
C24	7.5								
C25	800								
C26	1-4			829-4	3115-01-10	CT551			
C27	800			DD-801	801-801	DC-521			
C28	220			DD-221	811-221	UC-5322			
C29	68			TCN-68	N750K-680	NT-5468			
C30	800								
C31	800			DD-801	801-801	DC-521			
C32	220	1000	CCD221M	DD-221	1R5KV-221	DC-30322		C-3210	
C33	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C34	.22	200	CO-H-2224			PT4022	IMP2-P22	3302022	
C35	470		CCD471M	DD-471	831-471	UC-5347		K-1347	
C36	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C37	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C38	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C39	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C40	470		CCD471M	DD-471	831-471	UC-5347		K-1347	
C41	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C42	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C43	470		CCD471M	DD-471	831-471	UC-5347		K-1347	
C44	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C45	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C46	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C47	4.7		CO1083	TCZ-4R7	NP0A-4R7	ZT-555		KR-1550	
C48	.047	400	CO-H-4473	DF-503		PT4147	IMP4-S47	3304147	
C49	1000		CCD102X	DD-102	801-001	DC-521		K-1210	
C50	330		CCD331M	DD-331	811-331	UC-5333		K-1333	
C51	.1	400	CO-H-4104	DF-104		PT401	IMP4-P1	330401	
C52	10000		CCD103X	DD-103	811-01	DC-511			
C53	10000		CCD103X	DD-103	811-01	DC-511			
C54	330		CCD331M	DD-331	811-331	UC-5333		K-1333	
C55	330		CCD331M	DD-331	811-331	UC-5333		K-1333	
C56	330		CCD331M	DD-331	811-331	UC-5333		K-1333	

PARTS LIST AN

CAPACI

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACE: OLYMPIC PART No.	CENTRALAB PART No.	ERIE PART No.
C57	.0022	600	CO-H-6202	D6-222	GP2-333-22
C58	5000		CCD502X	DD-502	811-005
C59	10000		CCD103X	DD-103	811-01
C60	.002	600	CO-H-6202	D6-202	GP2-333-20
C61	330		CCD331M	DD-331	811-331
C62	.0047	600	CO-H-6472	D6-472	GP2-333-47
C63A	2000				
B	5000		♦PC2435	♦PC-100	♦1405-01
C	5000				
C64	.0047	600	CO-O-6472K	D6-472	GP2-333-47
C65	.047	400	CO-H-4473	DF-503	
C66	.1	400	CO-H-4104	DF-104	
C67	.02	400	CO-H-4203	DF-203	817-02
C68	5000		CCD502X	DD-502	811-005
C69	47	500	RCM20C470K	D6-470	831-470
C70	.047	400	CO-H-4473	DF-503	
C71	47	500	RCM20C471K	D6-470	831-470
C72	47	500	RCM20C471K	D6-470	831-470
C73	.02	400	CO-H-4203	DF-203	817-02
C74	.047	400	CO-H-4473	DF-503	
C75	.47	200	CO-H-2474		
C76	120	1000		DD-121	
C77	.01	600	CO-B-6103	D6-103	GP2-333-10
C78	.001	600	CO-O-6102K	D6-102	GP2L-102
C79	.001	600	CO-O-6102K	D6-102	GP2L-102
C80	.047	400	CO-H-4473	DF-503	
C81	.1	400	CO-H-4104	DF-104	
C82	.001	600	CO-O-6102K	D6-102	GP2L-102
C83	.0022	600	CO-H-6202	D6-222	GP2-333-22
C84	.1	400	CO-H-4104	DF-104	
C85	56	2000	CCD560K	DD30-560	3KV-560
C86	.01	600	CO-B-6103	DD-103	GP2-333-10

Note 1. Some versions use 180MMF in this application (Part #
♦ Items C63A, C63B, C63C, R65A, R65B, R65C are combine

CONTR

ITEM No.	RATING: RESISTANCE	RATING: WATTS	REPLACEMENT: OLYMPIC PART No.	IRC PART No.	CLAROSTA PART No.
R1A	1500Ω	½	PT3512	QJ-768 ♦	RTV-515
B	1Meg				
C	Switch				
R2A	50KΩ	½	PT2268-1	QJ1-123	A47-50K-S
B	Shaft		Not Req.	Not Req.	KSS-3
R3A	5000Ω	½	PT2271	QJ1-114	A47-5000-S
B	Shaft		Not Req.	RQ	KSS-3
R4A	1Meg	½	PT2269	QJ1-137	A47-1Meg-S
B	Shaft		Not Req.	Not Req.	KSS-3
R5A	2.5Meg	½	PT2272-1	QJ1-239	A47-2.5Me
B	Shaft		Not Req.	RQ	KSS-3
R6A	500KΩ	½	PT2270-1	QJ1-133	A47-500K-S
B	Shaft		Not Req.	Not Req.	KSS-3

Note 1. Some versions will use an alternate control part #PT226
Note 2. Some versions will use an alternate control part #PT227
Note 3. Some versions will use an alternate control part #PT226
Note 4. Some versions will use an alternate control part #PT227
Note 5. Some versions will use an alternate control part #PT227
♦ CONCENTRIKIT EQUIVALENT: K-2 KIT, BASE ELEMENTS

† Universal Replacement (Mallory exact duplicate part #UE1895)

RESISTO

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: OLYMPIC PART No.	IRC PART No.	NOTES
R7	8200Ω	½		BTS-8200	
R8	2200Ω	1		BTA-2200	
R9	22KΩ	½		BTS-22K	
R10	47KΩ	½		BTS-47K	
R11	270KΩ	½		BTS-270K	
R12	180KΩ	½		BTS-180K	
R13	680Ω	½		BTS-680	
R14	15KΩ	½		BTS-15K	
R15	100KΩ	½		BTS-100K	
R16	100KΩ	½		BTS-100K	
R17	100KΩ	½		BTS-100K	
R18	8200Ω	½		BTS-8200	
R19	10KΩ	½		BTS-10K	
R20	3300Ω	1		BTA-3300	
R21	150KΩ 5%	½		BTS-150K 5%	
R22	10KΩ	½	REB103K	BTS-10K	
R23	1000Ω	½	REB102M	BTS-1000	
R24	68Ω	½	REB680M	BTS-68	
R25	10KΩ	½	REB103K	BTS-10K	
R26	330Ω	½	REB331M	BTS-330	
R27	1000Ω	½	REB102M	BTS-1000	
R28	330Ω	½	REB331M	BTS-330	
R29	47Ω	½	REB470M	BTS-47	
R30	22KΩ	½	REB223K	BTS-22K	
R31	330Ω	½	REB331M	BTS-330	
R32	150Ω	½	REB151K	BTS-150	
R33	330Ω	½	REB331M	BTS-330	
R34	5600Ω	½	REB562K	BTS-5600	
R35	1Meg	½	REB105K	BTS-1Meg	
R36	10Meg	½	REB106M	BTS-10Meg	
R37	1.5Meg	½	REB155K	BTS-1.5Meg	
R38	1500Ω	½	REB152M	BTS-1500	

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: OLYMPIC PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	UHF Oscillator	6T4	6T4	7DE	
V2	RF Amplifier	6BZ7	6BZ7	9AJ	
V3	VHF Mixer-Osc.	6U8	6U8	9AE	
V4	1st. Video IF Amp.	6CB6	6CB6	7CM	
V5	2nd. Video IF Amp.	6CB6	6CB6	7CM	
V6	3rd. Video IF Amp.	6CB6	6CB6	7CM	
V7	Video Output	12BY7	12BY7	9BF	
V8	Sound IF Amp.	6AU6	6AU6	7BK	
V9	Ratio Det.	6AL5	6AL5	9BT	
V10	AF Amplifier	6AV6	6AV6	7BT	
V11	Audio Output	6W6GT	6W6GT	7B	
V12	Sync Sep.- Sync Limiter	12AU7	12AU7	9A	
V13	Sync Amp.- Vert. Osc.	12AU7	12AU7	9A	
V14	Vert. Output	6BL7GT	6BL7GT	9BD	
V15	Horiz. AFC- Horiz. Osc.	6BN7GT	6BN7GT	8BD	
V16	Horiz. Output	6BQ6GA	6BQ6GA	8AM	
V17	Damper	6W4GT	6W4GT	4CG	
V18	HV Rectifier	1B3GT	1B3GT	3C	
V19	LV Rectifier	5U4GA	5U4GA	5T	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA: OLYMPIC PART No.	CBS	GENERAL ELECTRIC	SYLVANIA	WESTINGHOUSE	RETMA BASE TYPE	NOTES
V20	17HP4	17HP4/ 17HP4	17HP4/17HP4	17HP4/ 17HP4	17HP4/ 17HP4	12L	① Aluminized ② Circuit changes necessary. ③ Silver screen
				17HP4B ③		12L	
	21ZP4B ①	21ZP4B ① 21ZP4A	21ZP4B ① 21ZP4A	21ZP4B ① 21ZP4A	21ZP4B ① 21ZP4A	12N	
				21ZP4 ②		12N	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: OLYMPIC PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C1A	60	350	CO-3380				*PT242.5	*TM-D60-400	D-190
B	80	350					TC-60	TC-4-450	FM-4504
C	4	350				MFT-1000			
C2	4	50	CO-3786			TC30		TC-4-50	MT-1504
C3	50	250	CO-2066			TC59		TC-50-450	FM-2540
C4A	40	300	CO-3381						MTD-4540
B	30	350							MTD-3530
C	125	35						TC-4-450	FM-4504
C5	4	450	CO-1056			TC70			
C6	2-5.5			529-5		CT752			
C7	800			DD-801	801-801	DC-521			
C8	800			DD-801	801-801	DC-521			
C9	1000			MFT-1000					
C10	1000			MFT-1000					
C11	33			TCN-33	N750K-330		NT-5433		
C12	6.8			TCZ-6R8	N90A-6R8		ZT-5568		
C13	8-3.5								
C14	800			DD-801	801-801		DC-521		
C15	3.6			TCZ-3R3	N90A-3R3		ZT-5533		
C16	8-3.5								
C17	800								
C18	1.5			TCZ-1R5	N90A-1R5		ZT-5515		
C19	47			DD-470	531-470		UC-5447		
C20	800								
C21	47			MFT-50					
C22	8-3.5								
C23	470			DD-471	831-471		UC-5947		
C24	7.5								
C25	800								
C26	1-4			529-4	3U5-01-10		CT751		
C27	800			DD-801	801-801		DC-521		
C28	220			DD-221	6U-221		UC-5333		
C29	68			TCN-68	N750K-680		NT-5468		
C30	800								
C31	800			DD-801	801-801		DC-521		
C32	220	1000	CCD221M	DD-221	1N3KV-221		DC-5322		C-5210
C33	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C34	.22	200	CO-R-2224				DC-5347	IMP2-P23	K-1247
C35	470		CCD471M	DD-471	831-471		UC-5947		K-1347
C36	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C37	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C38	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C39	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C40	470		CCD471M	DD-471	831-471		UC-5947		K-1347
C41	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C42	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C43	470		CCD471M	DD-471	831-471		UC-5947		K-1347
C44	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C45	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C46	1000		CCD102X	DD-102	801-001		DC-521		K-1210
C47	4.7		CC0803	TCZ-4R7	N90A-4R7		PT4167	IMP4-R47	K-1550
C48	.047	400	CO-H-4473	DF-503			PT4147	3304147	K-1310
C49	1000		CCD102X	DD-102	801-001		DC-521		K-1233
C50	330		CCD331M	DD-331	831-331		UC-5333		K-1333
C51	.1	600	CO-H-4104	DF-104			PT401	IMP4-P1	330401
C52	10000		CCD103X	DD-103	81J-01		DC-512		
C53	10000		CCD103X	DD-103	81J-01		DC-512		K-1333
C54	330		CCD331M	DD-331	831-331		UC-5333		K-1333
C55	330		CCD331M	DD-331	831-331		UC-5333		K-1333
C56	330		CCD331M	DD-331	831-331		UC-5333		K-1333

CAPACITORS (cont)

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: OLYMPIC PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C57	.0025	600	CO-H-5202	DE-322	GP3-333-322	PT5322	IMP6-D22	3306222	
C58	5000		CCD502X	DD-502	81J-005	DC-535	IMP6-D5	C-1250	
C59	10000		CCD103X	DD-103	81J-01	DC-511	IMP6-B1	330611	
C60	.002	600	CO-H-5202	DE-322	GP3-333-303	PT5322	IMP6-D22	3306222	
C61	330		CCD331M	DD-331	831-331	UC-5333		K-1333	
C62	.0047	600	CO-H-5472	DE-472	GP3-333-472	PT5347	IMP6-D47	3306347	
C63A	3000					DC-523	IMP6-D3	C-1230	
B	5000		*PC3435	*PC-100	*4405-01	DC-525	IMP6-D5	C-1250	
C	5000					DC-535	IMP6-D5	C-1250	
C64	.0047	600	CO-D-5472K	DE-472	GP3-333-472	PT5347	IMP6-D47	3306347	
C65	.047	400	CO-H-5473	DF-503		PT4147	IMP4-B47	3304147	
C66	.1	400	CO-H-4104	DF-104		PT401	IMP4-P1	330401	
C67	.03	400	CO-H-4303	DF-303	81T-03	PT413	IMP4-S3	330413	
C68	5000		CCD502X	DD-502	81J-005	DC-535	IMP6-D5	C-1250	
C69	47	500	RCM30C470K	DE-470	831-470	MCB235		KR-1447	
C70	.047	400	CO-H-4473	DF-503		PT4147	IMP4-B47	3304147	
C71	47	500	RCM30C471K	DE-470	831-470	MCB235		KR-1447	
C72	47	500	RCM30C471K	DE-470	831-470	MCB235		KR-1447	
C73	.03	400	CO-H-4303	DF-303	81T-03	PT413	IMP4-S3	330413	
C74	.047	400	CO-H-4473	DF-503		PT4147	IMP4-B47	3304147	
C75	.47	300	CO-H-3474			PT4047	IMP3-P47	3303047	
C76	120	1000		DD-121					Note 1
C77	.01	600	CO-H-5103	DE-103	GP3-333-103	PT5311	IMP6-S1	330611	
C78	.001	600	CO-H-5102K	DE-102	GP2L-102	PT521	IMP6-D1	330521	
C79	.001	600	CO-D-5102K	DE-102	GP2L-102	PT521	IMP6-D1	330521	
C80	.047	400	CO-H-4473	DF-503		PT4147	IMP4-B47	3304147	
C81	.1	400	CO-H-4104	DF-104		PT401	IMP4-P1	330401	
C82	.001	600	CO-H-5102K	DE-102	GP2L-103	PT521	IMP6-D1	330521	
C83	.0022	600	CO-H-5222	DE-222	GP3-333-222	PT5322	IMP6-D22	3306222	
C84	1	400	CO-H-4104	DF-104		PT401	IMP4-P1	330401	
C85	56	2000	CCD560K	DD30-560	3KV-560	DC30456			
C86	.01	600	CO-H-5103	DE-103	GP3-333-103	PT511	IMP6-S1	330611	

Note 1. Some versions use 180MMF in this application (Part #CM40C181K).
* Items C85A, C63B, C63C, R65A, R65B, R65C are combined in one unit.

CONTROLS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	REPLACEMENT DATA: OLYMPIC PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1500Ω	½	PT3512	QJ-765 *	RTV-515	F1-7	UF152R	Picture - Panel
B	1Meg					B3-53	UB38A † †	Volume - Rear
C	Switch					KB-1	UB-26	Attach to R1B
R2A	50KΩ	½	PT2268-1	QJJ-123	A47-50K-8	AB-31	U-35	Horiz. Hold - Note 1
B	Shaft		Not Req.	Not Req.	KBS-3	AE-4	Not Req.	Attach to R2A
R3A	5000Ω	½	PT2271	QJJ-114	A47-5000-8	AB-10	SU-14	Vert. Linearity-Note 2
B	Shaft		Not Req.	Not Req.	KBS-3	AE-4	Not Req.	Attach to R3A
R4A	1Meg	½	PT2269	QJJ-127	A47-1Meg-8	AB-59	U-54	Vert. Hold - Note 3
B	Shaft		Not Req.	Not Req.	KBS-3	AE-4	Not Req.	Attach to R4A
R5A	2.5Meg	½	PT2272-1	QJJ-329	A47-2.5Meg-8	AB-53	SU-553	Height - Note 4
B	Shaft		Not Req.	HQ	KBS-3	AE-4	Not Req.	Attach to R5A
R6A	500KΩ	½	PT2270-1	QJJ-133	A47-500K-8	AB-59	U-50	Brightness - Note 5
B	Shaft		Not Req.	Not Req.	KBS-2	AK-4	Not Req.	Attach to R6A

Note 1. Some versions will use an alternate control part #PT2268-2.
Note 2. Some versions will use an alternate control part #PT2271-2.
Note 3. Some versions will use an alternate control part #PT2269-2.
Note 4. Some versions will use an alternate control part #PT2272-2.
Note 5. Some versions will use an alternate control part #PT2270-2.
* CONCENTRIKIT EQUIVALENT: K-2 KIT, BASE ELEMENTS AND SHAFTS : R17-109, P1-105 (Panel) R13-157, R1-122 (Rear) 76-1 SWITCH
† Universal Replacement (Mallory exact duplicate part #UB1885)

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: OLYMPIC PART No.	IRC PART No.	NOTES
R7	820Ω	½		BTS-8200	
R8	2200Ω	1		BTA-2200	
R9	22KΩ	½		BTS-22K	
R10	47KΩ	½		BTS-47K	
R11	270KΩ	½		BTS-270K	
R12	180KΩ	½		BTS-180K	
R13	680Ω	½		BTS-680	
R14	15KΩ	½		BTS-15K	
R15	100KΩ	½		BTS-100K	
R16	100KΩ	½		BTS-100K	
R17	100KΩ	½		BTS-100K	
R18	820Ω	½		BTS-8200	
R19	10KΩ	½		BTS-10K	
R20	3300Ω	½		BTA-3300	
R21	150KΩ	5% 1		BTS-150K 5%	
R22	10KΩ	½	RES103K	BTS-10K	
R23	68Ω	½	RES803M	BTS-68	
R24	10KΩ	½	RES103K	BTS-10K	
R25	330Ω	½	RES331M	BTS-330	
R26	1000Ω	½	RES103M	BTS-1000	
R27	330Ω	½	RES331M	BTS-330	
R28	47Ω	½	RES47OM	BTS-47	
R29	33KΩ	½	RES333K	BTS-33K	
R30	330Ω	½	RES331M	BTS-330	
R31	150Ω	½	RES151K	BTS-150	
R32	330Ω	½	RES331M	BTS-330	
R33	150Ω	½	RES151K	BTS-150	
R34	5600Ω	½	RES562K	BTS-5600	
R35	1Meg	½	RES105K	BTS-1Meg	
R36	10Meg	½	RES106M	BTS-10Meg	
R37	1.5Meg	½	RES155K	BTS-1.5Meg	
R38	1500Ω	½	RES152M	BTS-1500	

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: OLYMPIC PART No.	IRC PART No.	NOTES
R39	33KΩ	2	RED333M	BTB-33K	
R40	22KΩ	2	RED223M	BTB-22K	
R41	4700Ω	2	RED472K	BTB-4700	
R42	220KΩ	2	RES224M	BTS-220K	
R43	100KΩ	2	RED104M	BTS-100K	
R44	47KΩ	2	RED473M	BTS-47K	
R45	1000Ω	2	RED102M	BTS-1000	
R46	150Ω	2	RED151M	BTS-150	
R47	22KΩ	2	RES223M	BTS-22K	
R48	10KΩ	2	RED103K	BTS-10K	
R49	10KΩ	2	RED103K	BTS-10K	
R50	10Meg	2	RES106M	BTS-10Meg	
R51	100KΩ	2	RED104K	BTS-100K	
R52	330KΩ	2	RES334KA	BTS-330K	
R53	330Ω	2	RED331M	BTB-330	
R54	220KΩ	2	RES224M	BTS-220K	
R55	2.2Meg	2	RES225K	BTS-2.2Meg	
R56	47KΩ	2	RES473K	BTS-47K	
R57	56KΩ	2	RES563K	BTA-56K	
R58	220KΩ	2	RES224K	BTS-220K	
R59	22KΩ	2	RES223K	BTS-22K	
R60	22KΩ	2	RES223K	BTS-22K	
R61	1Meg	2	RES105K	BTS-1Meg	
R62	10KΩ	2	RES103K	BTS-10K	
R63	2700Ω	2	RES272K	BTS-2700	
R64	82KΩ	2	RES823K	BTS-82K	
R65A	22KΩ	½		BTS-22K	
B	8200Ω	½	*PC2625	BTS-8200	
C	8200Ω	½		BTS-8200	
R66	1.5Meg	½	RES155K	BTS-1.5Meg	
R67	470KΩ	½		BTS-470K	
R68	2.5Meg	½	RES255M	BTS-2.5Meg	

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: OLYMPIC PART No.	IRC PART No.	NOTES
R85	180KΩ	½	RES184KA	BTS-180K	
R86	150KΩ	5% 1	RES154KA	BTA-150K 5%	
R87	330KΩ	5% 1	RES334JA	BTA-330K 5%	
R88	8200Ω	½	[illegible]	BTS-8200	
R89	22KΩ	½	RES223M	BTS-22K	
R90	68KΩ	1	RES683KA	BTA-68K	
R91	15KΩ	½	RES153M	BTA-15K	
R92	560KΩ	½		BTS-560K	Note 2
R93	47Ω	1	RES470M	BTS-47	
R94	18KΩ	3	RED183K	BTB-15K	
R95	100KΩ	3	RED104M	BTS-100K	
R96	47KΩ	3	RED473M	BTS-47K	
R97	330KΩ	2	RED334M	BTS-330K	
R98	2700Ω	3	RES272K	BTS-2700	
R99	400Ω	20	RES3469	20-400	
R100	100KΩ	½	REC104M	BTA-100K	

* Items R85A, R85B, R85C, C83A, C83B, C83C are combined in one unit.
Note 1. Some versions use a 330KΩ resistor in this application.
Note 2. Some versions use a 470KΩ resistor in this application.

RESISTORS (cont)

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: OLYMPIC PART No.	IRC PART No.	NOTES
R69	12KΩ	½	RES123K	BTS-12K	
R70	3.3Meg	½	RES335M	BTS-3.3Meg	
R71	560Ω	½	RES561K	BTS-560	
R72	330Ω	½	RES331M	BTS-330	
R73	220KΩ	½	RES224M	BTS-220K	
R74	22KΩ	1	REC223M	BTA-22K	
R75	560Ω	½	RES561K	BTS-560	
R76	560Ω	½	RES561K	BTS-560	
R77	330KΩ	½	RES334KA	BTS-330K	
R78	82KΩ 5%	1	REC823JA	BTA-82K 5%	
R79	820KΩ	1	REC824KA	BTA-820K	
R80	390Ω	½	RES391K	BTS-390	
R81	82KΩ	½	RES833K	BTS-82K	
R82	68KΩ	1	REC683KA	BTA-68K	
R83	47KΩ	1	REC473M	BTA-47K	
R84	150KΩ	½	RES154KA	BTS-150K	

TRANSFORMER (POWER)

ITEM No.	RATING: PRI.	RATING: SEC. 1	RATING: SEC. 2	REPLACEMENT DATA: OLYMPIC PART No.	Halldorson PART No.	Merit PART No.	RCA TYPE No	Stancor PART No.	Thorderson PART No.	Triad PART No
T1	117VAC ①1.42A	600VCT ②.180ADC	5VAC ③ 3A	TH-3770		P-3836		P-8335 ①		R-39BC①
	SEC. 3	SEC. 4	SEC. 5							
	6.3VAC ①1.2A	6.3VAC ②.8.7A								

① Drill new mounting holes.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	REPLACEMENT DATA: OLYMPIC PART No.	Halldorson PART No.	Merit PART No.	RCA PART No.	Ram TYPE No.	Stancor PART No.	Thorderson PART No.	Triad PART No.
T3	Vert.Osc. Trans.	TR1473	S6703	A-3003	209T1 ①	Y606	A-8125	25A03	A-97X
T2	Horiz.Output Trans.	TR2711-2 FB41 *		H-VO-9 *	230T1 *	X060 *	A-8252 *	FLT-34 *	D-19 *
T4	Vert.Output Trans.	TR2711-1 ② TR3385	Z1805	A-3036	204T9 ①	V309	A-8113	26S51	A-99X ①
T5A	Yoke-Horiz.(13.5MH)	CL5753	DF602 ③	MDP-72 ③	21LD3 ③	YT70P16/45 ③	A-8113	DY-8A ③	Y-7 ③ Y-7-1 ③
B	Vert.(57MH)								

① Drill new mounting hole(s).
② Alternate horizontal output transformer.
③ Connect horizontal damping network across terminals #3 and #7. Use original network if necessary.
④ Remove damping capacitor from terminals #1 and #2. Use original horizontal damping network if necessary.

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

ORIGINAL TERMINAL CONNECTIONS	Halldorson Replacement Connections	Merit Replacement Connections	RCA Replacement Connections	Ram Replacement Connections	Stancor Replacement Connections	Thorderson Replacement Connections	Triad Replacement Connections
9	9	9	9	9	9	9	9
8 & 7	8	8	8	Jumper 8 & 7	Jumper 8 & 7	8	Jumper 8 & 7
5	5	5	5	4	5	5	5
4	4	4	4	T	4	4	4
3	3	3	3	3	3	3	3
1	1	1	1	1	1	1	1

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE: PRI.	IMPEDANCE: SEC.	OLYMPIC PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thorderson PART No.	Triad PART No.	NOTES
T6	2.4KΩ	3.5Ω	TR-2786-1	Z1101	A-3025	A-3323	26S58 ①	S-12X	① Drill one new mounting hole.

SPEAKER

ITEM No.	RATINGS: SIZE	FIELD	V C IMP	REPLACEMENT DATA: OLYMPIC PART No.	QUAM PART No.	NOTES
SP1	5"	PM	3.5Ω	SK-1706-3	5A07	① Used in Model 21CX19
	8"	PM	3.5Ω	SK-1606-3 ①	8A31	

PARTS LIST AND DESCRIPTIONS (Continued)

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA OLYMPIC PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	UHF Ant. Coil	0Ω CT						
L2	UHF RF Coil	0Ω						
L3	UHF Osc. Coupling Coil	0Ω						
L4	Fil. Choke	0Ω						
L5	Fil. Choke	0Ω						
L6	Cathode Choke	0Ω						
L7	UHF IF Output	0Ω CT						
L8	VHF Ant. Coils	0Ω CT	0Ω					
L9	Neut. Coil	0Ω						
L10	VHF RF, Mixer Grid, & Osc. Coils	0Ω						
L11	Fil. Choke	0Ω						
L12	Conv. Plate	.1Ω						
L13	1st. Video IF	.2Ω		CL3497	17-5001 *	TV-125 *	6231 *	
L14	RF Choke	2.4Ω		CL1535	19-3036	TV-180	6176	36 Microhenries
L15	2nd. Video IF	.3Ω	.3Ω	CL3498	17-5002	TV-127	6232	Includes 41.25MC trap
L16	Fil. Choke	0Ω		CL2427	19-1001		4604	1.4 Microhenries
L17	3rd. Video IF	.2Ω	.2Ω	CL3499	17-4521 ■	TV-128	6233	Includes 47.25MC trap
L18	Fil. Choke	0Ω		CL2427	19-1001		4604	1.4 Microhenries
L19	4th. Video IF	.3Ω	.3Ω	CL3500	17-5004	TV-125	6234	
L20	Series Peaking Coil	2.4Ω		CL1535	19-3036	TV-180	6176	36 Microhenries
L21	Series Peaking Coil	3.9Ω		CL3401	19-3075	TV-181	6172	80 Microhenries, wound on 22KΩ resistor
L22	Shunt Peaking Coil	8.5Ω		CL3403	19-3300 ▲	TV-190 ▲	6155 ▲	300 Microhenries, wound on 1Meg resistor
L23A	4.5MC trap	1.9Ω		TR3386				
B	Sound IF	1.9Ω						
L24	Series Peaking Coil	8Ω		CL3398	19-3250 ♦	TV-185 ♦	6181 ♦	250 Microhenries, wound on 15KΩ resistor
L25	Shunt Peaking Coil	10Ω		CL3403	19-3300 ▲	TV-190 ▲	6155 ▲	300 Microhenries, wound on 1Meg resistor
L26	Ratio Det.	5.3Ω	1.8ΩCT	TR2630	17-3497	TV-115	6205	Tertiary winding-.6Ω
L27	Horiz. Osc.	21Ω	53Ω	TR1224	20-1402	TV-162	6183	Waveform winding -43Ω

* Use one winding only.
■ Drill mounting holes.
▲ Parallel with 1Meg resistor.
♦ Parallel with 15KΩ resistor.

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA OLYMPIC PART No. FUSE	OLYMPIC PART No. HOLDER	LITTELFUSE PART No. FUSE	LITTELFUSE PART No. HOLDER	BUSS PART No. FUSE	BUSS PART No. HOLDER
M1	3AG P/T	3/8A 250V	FU3492		318.375 (3AG P/T - 3/8A)		GJV 3/8	

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA OLYMPIC PART No.	REPLACEMENT DATA SYLVANIA PART No.	NOTES
M2	1N82A		1N82A	UHF Mixer
M3	1N64 *	1N64 or 1N60	1N60 or 1N132	Video Detector

* Some versions may use 1N60 type crystal diode in this application.

MISCELLANEOUS

ITEM No.	PART NAME	OLYMPIC PART No.	NOTES
M4	Dial Light	BU187	#47
M5	Tuner	CL3496	VHF-UHF
M6	Trap	83A64917-3	VHF Ant. Input Filter
M7	Focus Magnet	PP3379	"X" Chassis , includes centering device
M8	Centering Device	PP2763	"W" Chassis
M9	Ion Trap	PP2623	"W" Chassis
	Ion Trap	PP2248	"X" Chassis
B3	Trimmer Cap.	CT3526	Horiz. Drive (110-580MMF)
	Cabinet	CA3248-3	Model 17TW27
	Cabinet	CA3246-4	Model 21TX28
	Cabinet	CA3296-3	Model 21CX29
	Knob	KN3543	On-off-volume - Maroon
	Knob	KN3543-1	On-off-volume - Tan
	Knob	KN3544	Contrast - Maroon
	Knob	KN3545	Channel Selector - Maroon
	Knob	KN3545-1	Channel Selector - Tan
	Knob	KN3546	Fine tuning
	Dial	DL3547	UHF Indicator
	Safety Glass	PP2937	Model 17TW27
	Safety Glass	PP3393-1	Models 21TX28, 21CX29
	Mask	PP2939	Model 17TW27
	Mask	PP2940	Models 21TX28, 21CX29

TROUBLE SHOOTING AIDS (cont)

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V15, V16, V17 and V18. Check fuse, M1. Check waveform W14.

If Satisfactory	If Unsatisfactory
Check T3, T5A, C84, C83, C82, C81, C80, R94, R95 and other associated components.	Check C76, C77, C79, L17, R91, R90, R88, R2 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V16, V17 and V19. Check T3, T5A, C79, R94, R95 and other associated components.

BLOOMING

Check by substitution V16, V17, V18 and V19. Check C77, C78, C79, R94, R95 and other associated components.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video".

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or no Sound".

RASTER, NO SOUND, NO PICTURE

Check by substitution V2, V3, V4, V5, V6, V7, and V11. Check video IF components for failure or change of value. Raster, No Sound, No Picture, UHF, substitute V1.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set".

KEYSTONE EFFECT

Check T5 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

Touch-up adjustments of the VHF tuner oscillator circuit may be accomplished by removal of the channel selector and fine tuning knobs. The adjustments are accessible, one at a time, thru the small hole in the cabinet above and slightly to the left of the channel selector shaft.

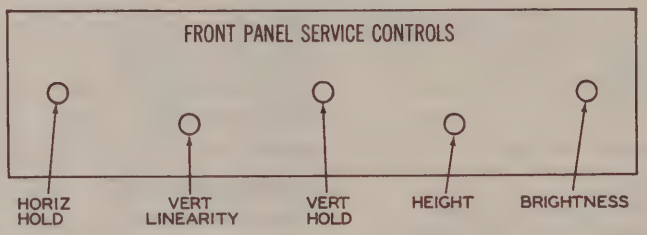
PICTURE TUBE SAFETY GLASS CLEANING

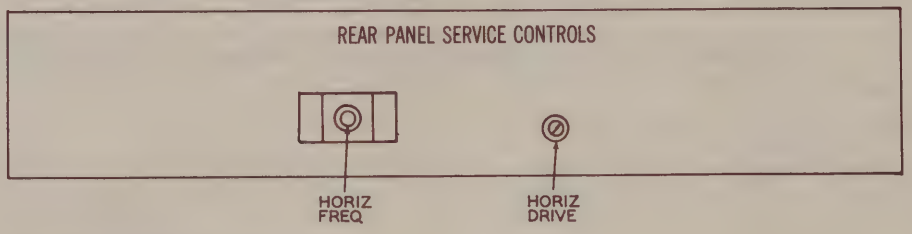
To clean safety glass, remove 3 wood screws holding wood strip at the top of the safety glass. Remove wood strip and safety glass. Use extreme caution when removing safety glass.

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION





HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

Adjustment of the horizontal oscillator is located on the rear panel of the chassis. Set the horizontal hold control at the center of its range and adjust the horizontal frequency slug (B1) until picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the ratio detector secondary (L26) located on top of chassis.

FUSES

One fuse is used for horizontal sweep circuit protection. (For location see tube placement chart).

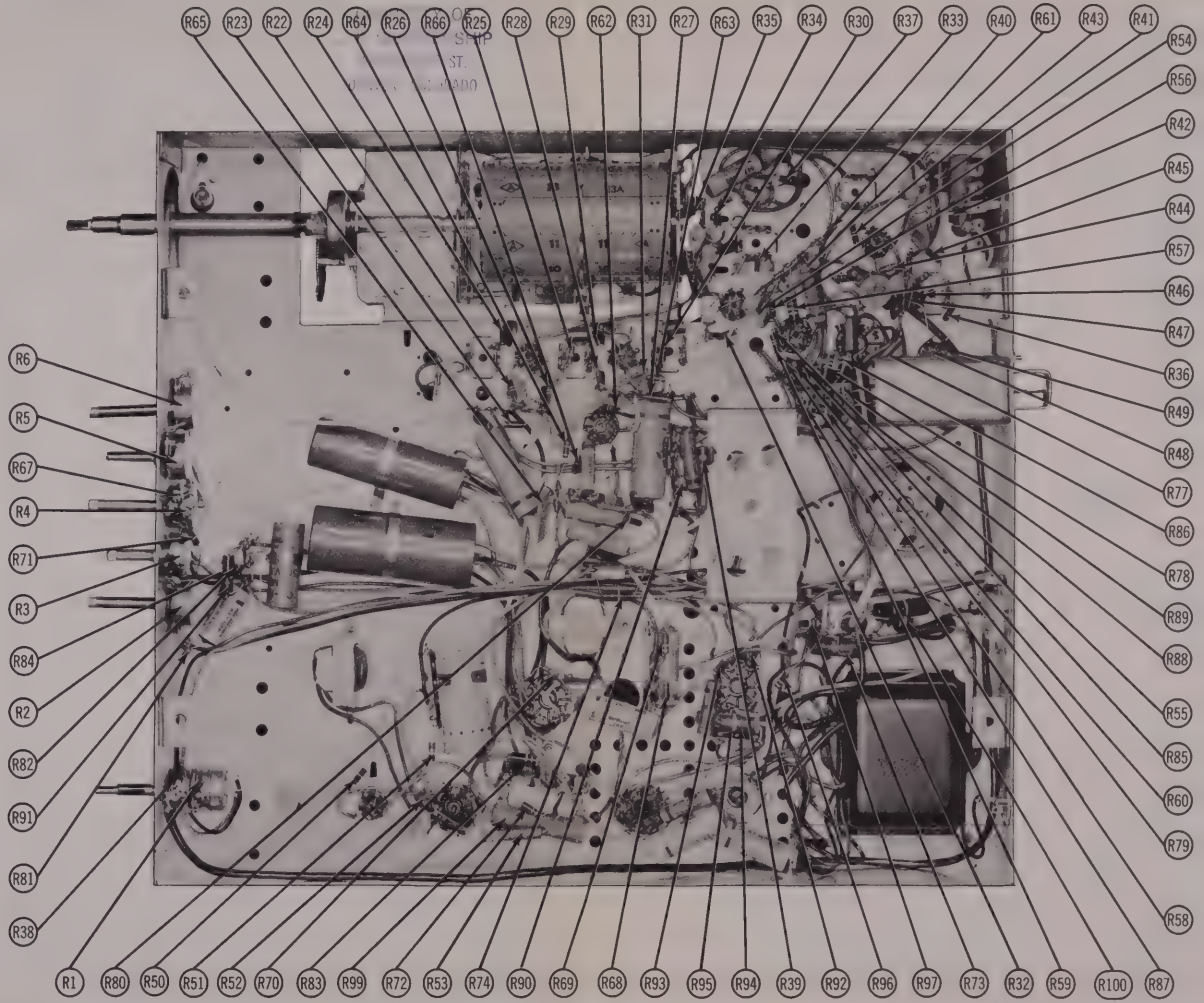
CENTERING

Centering is accomplished mechanically by adjusting two magnetic rings around the neck of the picture tube, located flush against the deflection yoke. Rotate the two rings around the neck of the tube until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

CHASSIS REMOVAL

1. Remove 4 push-on type control knobs from front panel of cabinet.
2. Remove 2 metal screws. Remove rear cover.
3. Disconnect speaker plug.
4. Remove 5 chassis bolts. Remove chassis.
5. Remove 2 speaker nuts. Remove speaker.



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

SILVERTONE MODELS 5045, 5046 (Ch. 528.34900)

SILVERTONE MODELS 5045, 5046 (Ch. 528.34900)

SILVERTONE MODELS 5045, 5046 (Ch. 528.34900)

TRADE NAME	Silvertone Models 5045, 5046 (Ch. 528.34900)
SUPPLIER	Sears Roebuck & Co., 925 S. Homan, Chicago, Ill.
TYPE SET	AC Operated Radio-Phono Combination AM Superheterodyne Receiver With 3 Speed Automatic Record Changer
TUBES (Six)	Types 12BE6 Conv., 12BA6 IF Amp., 12AT6 Det.-AVC-AF Amp., 12AT6 Phase Inverter, (2) 35C5 Output
POWER SUPPLY	105-120 Volts AC-60 Cycles — RATING .31 Amp. @ 117 Volts AC
TUNING RANGE—BROADCAST	535KC-1630KC

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.
Loop should be maintained in same relative position to chassis as when receiver is in cabinet.
Use isolation transformer, if available. If not, connect a .1MFD capacitor in series with low side of signal generator and chassis.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1.	.1MFD	High side to pin 7 (grid) of 12BE6 (V1). Low side to chassis.	455KC (400~Mod)	Tuning gang fully open	Across voice coil	A1, A2, A3, A4	Adjust for maximum output. If isolation transformer is not used, reduce dummy antenna to .001MFD to reduce hum modulation.
2.	"	"	1630KC	"	"	A5	"
3.		Loop	1400KC	1400KC	"	A6	Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output.

FOR SERVICE INFORMATION ON RECORD CHANGER UNIT SILVERTONE CHASSIS 567.30000 - SEE SIMILAR CRESCENT MODEL 500 SERIES - PHOTOFACT SET 197 — FOLDER 4 OR RECORD CHANGER MANUAL CM-5.

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

SILVERTONE
MODEL 5045 (Ch. 528.34900)

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		Silvertone PART No.	STANDARD REPLACEMENT		
V1	Converter	12BE6	12BE6	7CH	
V2	IF Amp.	12BA6	12BA6	7BK	
V3	Det.-AVC-AF Amp	12AT6	12AT6	7BT	
V4	Phase Inv.	12AT6	12AT6	7BT	
V5	Audio Output	35C5	35C5	7CV	
V6	Audio Output	35C5	35C5	7CV	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT	Silvertone PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1A	50	150	T18-304			TCD497	TDL-5030-150	FMD-301	
B	30	150							
C2	.05	200	T16-197	DF-503		PT415	IMP2-S5	330215	
C3	47		T15-229	TCN-47	N750K-470	NT-5447			
C4	.05	200	T16-197	DF-503		PT415	IMP2-S5	330215	
C5	150		T15-251	TCN-150	N750-337-151				
C6	.05	400	T16-189	DF-503		PT415	IMP4-S5	330415	
C7	25	500	T15-256	TCZ-25	NP0L-250	MCB220		KR-1424	
C8	.02	400	T16-150	D6-203	817-02	PT412	IMP4-S2	330412	
C9	20000		T15-240	DD-203	817-02	PT612	IMP6-S2	330612	
C10	.003	600	T16-200	D6-302	GP2-333-302	PT623	IMP6-D3	330623	
C11	.1	200	T16-203	DF-104		PT401	IMP2-P1	330201	
C12A	10000		♦T17-110	♦PC-81	1404-02				
B	250								
C									
C13	5000		T16-177	DD-502	811-005	DC-525	IMP6-D5	330625	
C14A	10000		†T17-110	†PC-81	1404-02				
B	250								
C									
C15	.001	600	T16-254	D6-102	GP2L-102	PT621	IMP6-D1	330221	
C16	.001	600	T16-254	D6-102	GP2L-102	PT621	IMP6-D1	330221	
C17	.047	400	T16-447	DF-503		PT4147	IMP4-S47	3304147	
C18	.05	400	T16-189	DF-503		PT415	IMP4-S5	330415	

♦ Items C12A, C12B, C13C, R8A and R8B are combined in one unit.
When replacing items separately, items C12B and C12C should total 250MMF.
† Items C14A, C14B, C14C, R10A and R10B are combined in one unit.
When replacing items separately, items C14B and C14C should total 250MMF.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Silvertone PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	500KΩ	½	A24-224			F1-40	UF55L	Tone - Panel
B	1Meg	½				R2-61	UR16-T1253	Volume-tapped @ 70KΩ-rear
C	Switch					KB-1	US-26	Attach to R1B

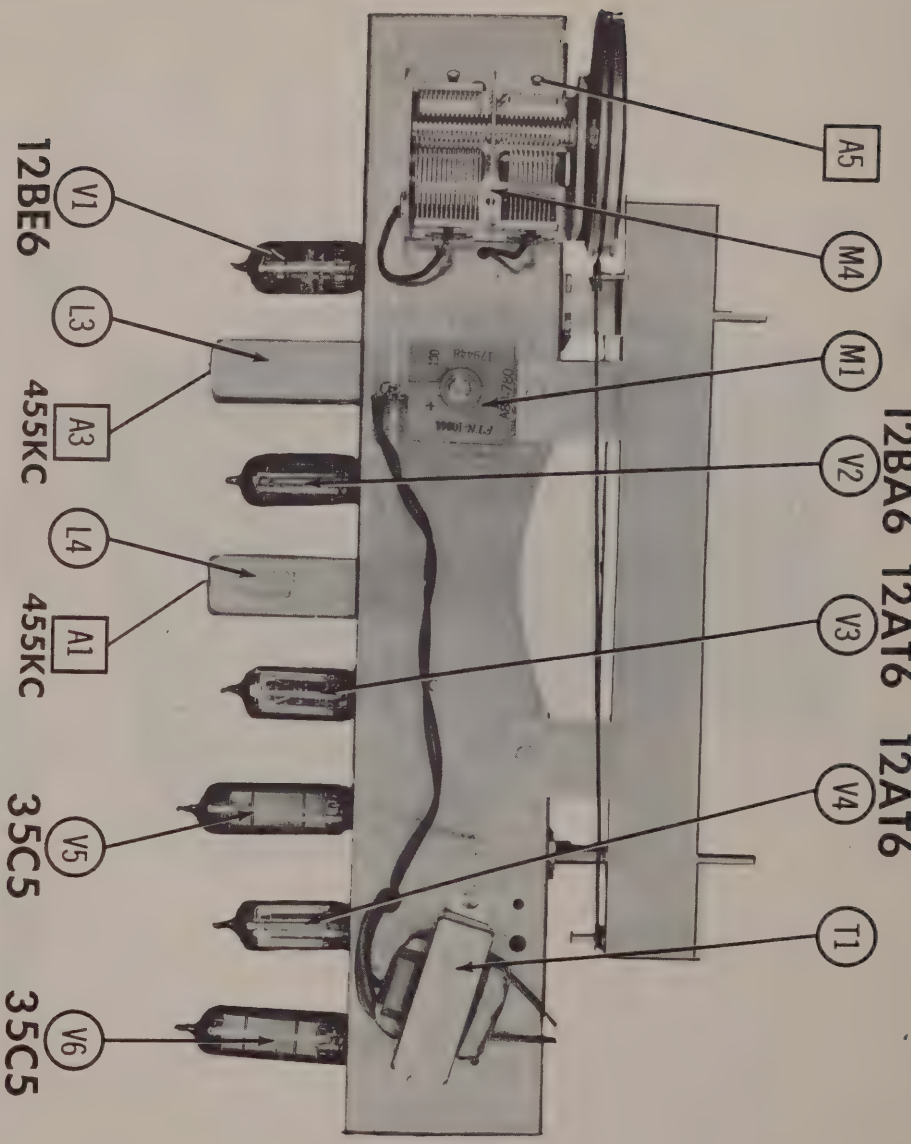
RESISTORS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Silvertone PART No.	IRC PART No.	
R2	22KΩ	½	S602230M	BTS-22K	
R3	82Ω	½	S608200K	BTS-82	
R4	47KΩ	½	S604730M	BTS-47K	
R5	1Meg	½	S601050M	BTS-1Meg	
R6	22KΩ	½	S602230M	BTS-22K	
R7	10Meg	½	S601060M	BTS-10Meg	
R8A	500KΩ	½	♦T17-110	BTS-470K	
B	250KΩ	½		BTS-220K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Silvertone PART No.	IRC PART No.	
R9	10Meg	½	S601060M	BTS-10Meg	
R10A	500KΩ	½	†T17-110	BTS-470K	
B	250KΩ	½		BTS-220K	
R11	100KΩ	½	S601040M	BTS-100K	
R12	220KΩ	½	S602240M	BTS-220K	
R13	100Ω	½	S601010K	BTS-100	
R14	1200Ω	1	S601221K	BTA-1200	
R15	33Ω	3	T61-10		
R16	220KΩ	½	S602240M	BTS-220K	

♦ Items R8A, R8B, C12A, C12B and C12C are combined in one unit.
† Items R10A, R10B, C14A, C14B and C14C are combined in one unit.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA Silvertone PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T1	5.6KΩ CT	6.8Ω	80-295	Z1007	A-2901	A-3823	22S61	S-53X	

SPEAKER

ITEM No.	RATINGS SIZE	RATINGS FIELD	RATINGS V. C. IMP.	REPLACEMENT DATA Silvertone PART No.	QUAM PART No.	NOTES
SP1	6"	PM	3.4Ω	79-417	6A1LF	
SP2	6"	PM	3.4Ω	79-417	6A1LF	

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA Silvertone PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	Ant. Coil	.1Ω		T82-72				Includes trimmer
L2	Osc. Coil	.8Ω	7.8Ω	T10-645	14-1074	BC-381 *	70-OSC	
L3	Input IF	19Ω	19Ω	T10-508	16-6758	BC-352	12-C1	
L4	Output IF	20Ω	20Ω	T10-479	16-6758	BC-353	12-C2	

* Drill mounting hole.

SELENIUM RECTIFIER

ITEM No.	RATING CURRENT	REPLACEMENT DATA Silvertone PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	NOTES
M1	.087A	83-780	1004A	RS-100	6S100	5M1	100	

PHONO CARTRIDGE

ITEM No.	REPLACEMENT DATA Silvertone PART No.	ASTATIC PART No. CARTRIDGE	ASTATIC PART No. NEEDLE	ELECTRO-VOICE PART No. CARTRIDGE	ELECTRO-VOICE PART No. NEEDLE	REMARKS
M2	Y720044	55-T	GD-J	47	0-1 or S-1 & 0-3	

ASTATIC AND ELECTRO-VOICE NEEDLE LISTINGS SHOWN ABOVE ARE SPECIFIED FOR THE RESPECTIVE REPLACEMENT CARTRIDGES LISTED. FOR ORIGINAL CARTRIDGE NEEDLE REPLACEMENT SEE BELOW.

PHONO NEEDLE

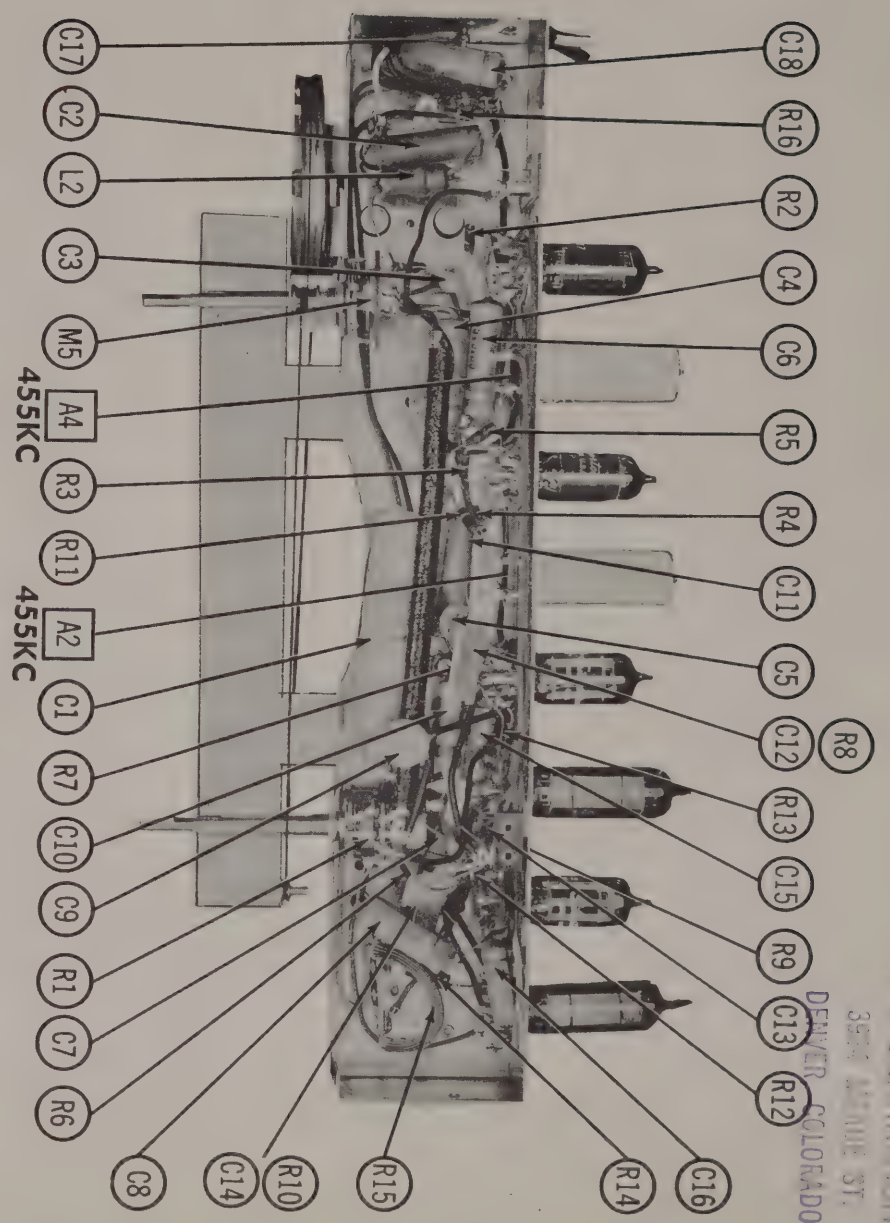
(FOR REPLACEMENT IN ORIGINAL EQUIPMENT CARTRIDGE)

ITEM No.	REPLACEMENT DATA Silvertone PART No.	JENSEN PART No.	PERMO PART No.	WALCO PART No.	REMARKS
M3	5742	*S-67 or †S-66 or ♦†S-66SD or ♦S-66D	†AC-434 or ♦†AC-434D1 or †AAC-434D2 or ♦AC-434D	†W-75TPD or ♦†W-75DS or ♦W-75TPD	* Metal † Jewel ♦ Diamond

MISCELLANEOUS

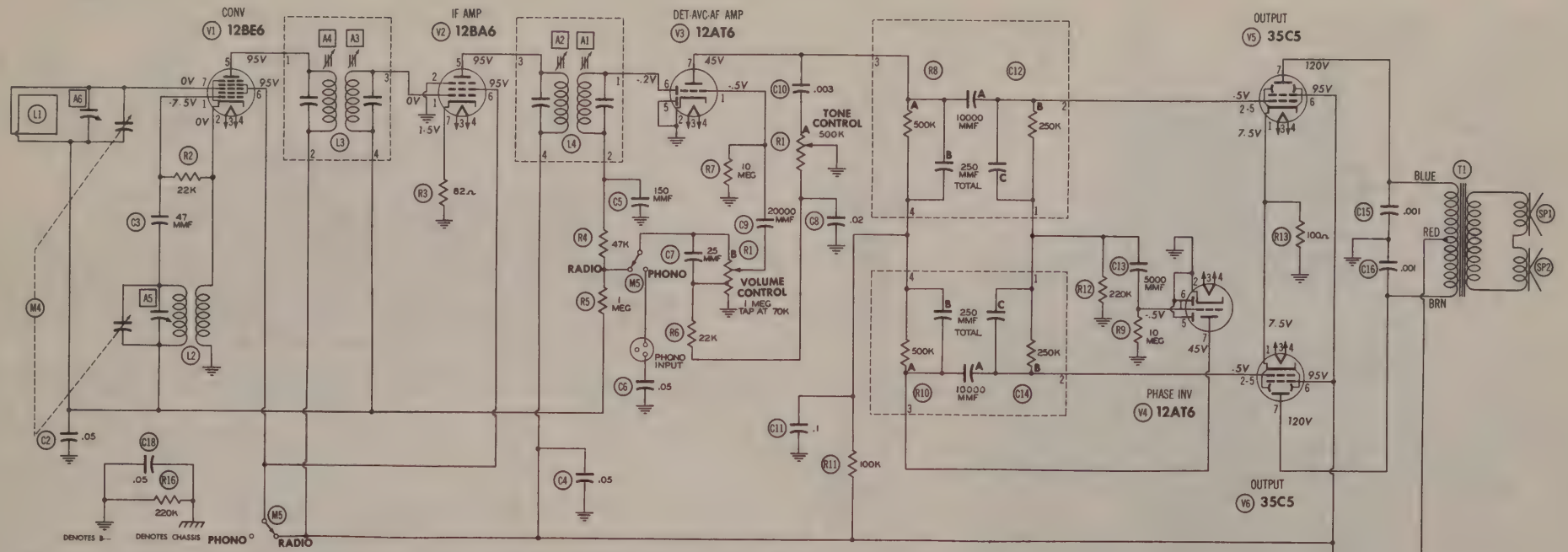
ITEM No.	PART NAME	Silvertone PART No.	NOTES
M4	Tuning Cap.	T19-231	2 Gang (11-475MMF, 15-185MMF)
M5	Switch	T69-203	Radio-Phono
	Cabinet	T42-727	Model 5045
	Cabinet	T42-735	Model 5046
	Knob	T52-568	Tuning & tone
	Knob	T52-569	On-off-volume & Radio -Phono Switch
	Dial Scale	T67-586	
	Dial Pointer	T58-111	

CHASSIS—BOTTOM VIEW



SILVERTONE
MODEL 5045 (Ch. 528.34900)
L. F. SHAMWAY
3554 LEYDEN ST.
DENVER, COLORADO

SILVERTONE
MODEL 5045 (Ch. 528.34900)



IF = 455 KC

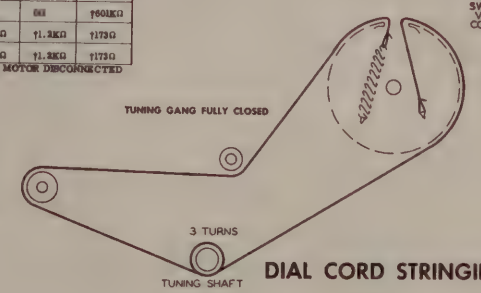
THE COOPERATION OF THE MANUFACTURER OF THIS RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

RESISTANCE READINGS

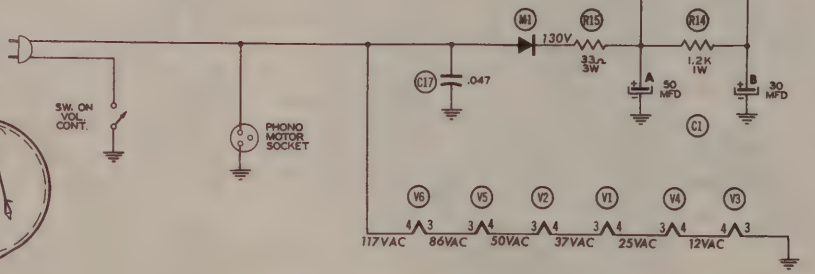
Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V 1	12BE6	22KΩ	1.5Ω	37Ω	25Ω	†1.2KΩ	†1.2KΩ	2Meg
V 2	12BA6	2Meg	0Ω	50Ω	37Ω	†1.2KΩ	†1.2KΩ	82Ω
V 3	12AV6	10Meg	0Ω	12Ω	0Ω	0Ω	1.4Meg	†60IKΩ
V 4	12AV6	10Meg	0Ω	25Ω	13Ω	0Ω	0Ω	†60IKΩ
V 5	35C5	100Ω	470KΩ	85Ω	50Ω	470KΩ	†1.2KΩ	†173Ω
V 6	35C5	10Ω	470KΩ	85Ω	115Ω	470KΩ	†1.2KΩ	†173Ω

ALL MEASUREMENTS TAKEN IN RADIO POSITION WITH PHONO MOTOR DISCONNECTED
† MEASURED FROM OUTPUT OF M1

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.



DIAL CORD STRINGING



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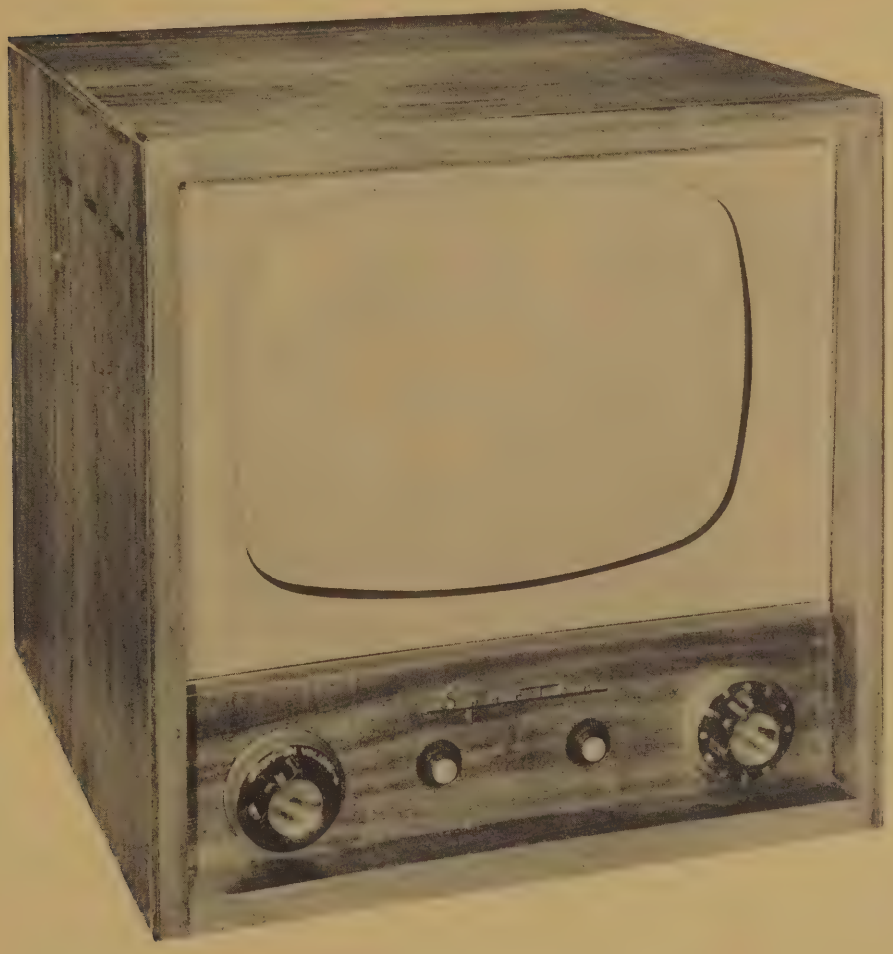

MODEL 24T201

SPARTON MODELS 17A203, 17A204, 18A203, 18A204, 19A203, 19A204, 19A209, 19A210, 20T203, 20T204, 20T209, 20T210, 20T403, 20T404, 21T203, 21T204, 22A403, 22A404, 24T201, 24T202, 24T301 (Ch. 22V174B, 22V214B, 23U174B, 23U214B)

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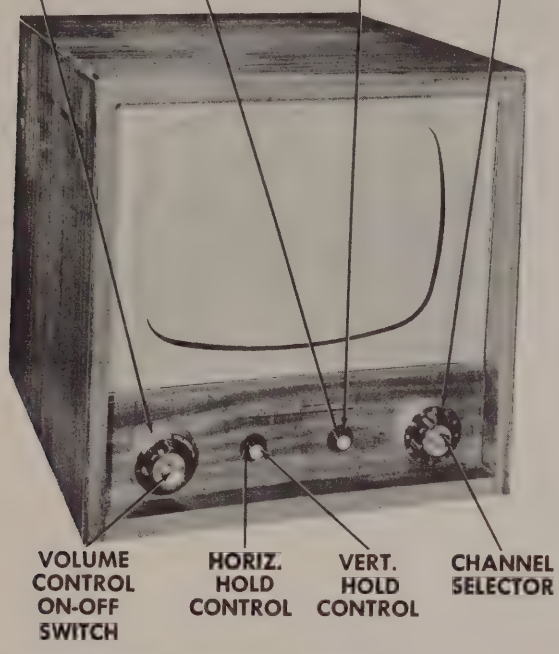

SPARTON MODEL 24T201 (Ch. 22V174B)

TRADE NAME	Sparton	MODELS	CHASSIS
		24T201, 24T301	22V174B
		17A203, 18A203, 19A203, 19A209, 20T203, 20T209, 20T403, 21T203, 22A403	22V214B
		24T202	23U174B
		17A204, 18A204, 19A204, 19A210, 20T204, 20T210, 20T404, 21T204, 22A404	23U214B
MANUFACTURER	Sparton, Div. of Sparks - Withington Co., Jackson, Michigan		
TYPE SET	Television Receiver		
TUBES	Twenty-three		
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING 1.66 Amp. @ 117 Volts AC	
TUNING RANGE	Channels 2 thru 13 VHF, 14 thru 83 UHF, Video IF 45.75MC, Sound IF 41.25MC (Intercarrier)		

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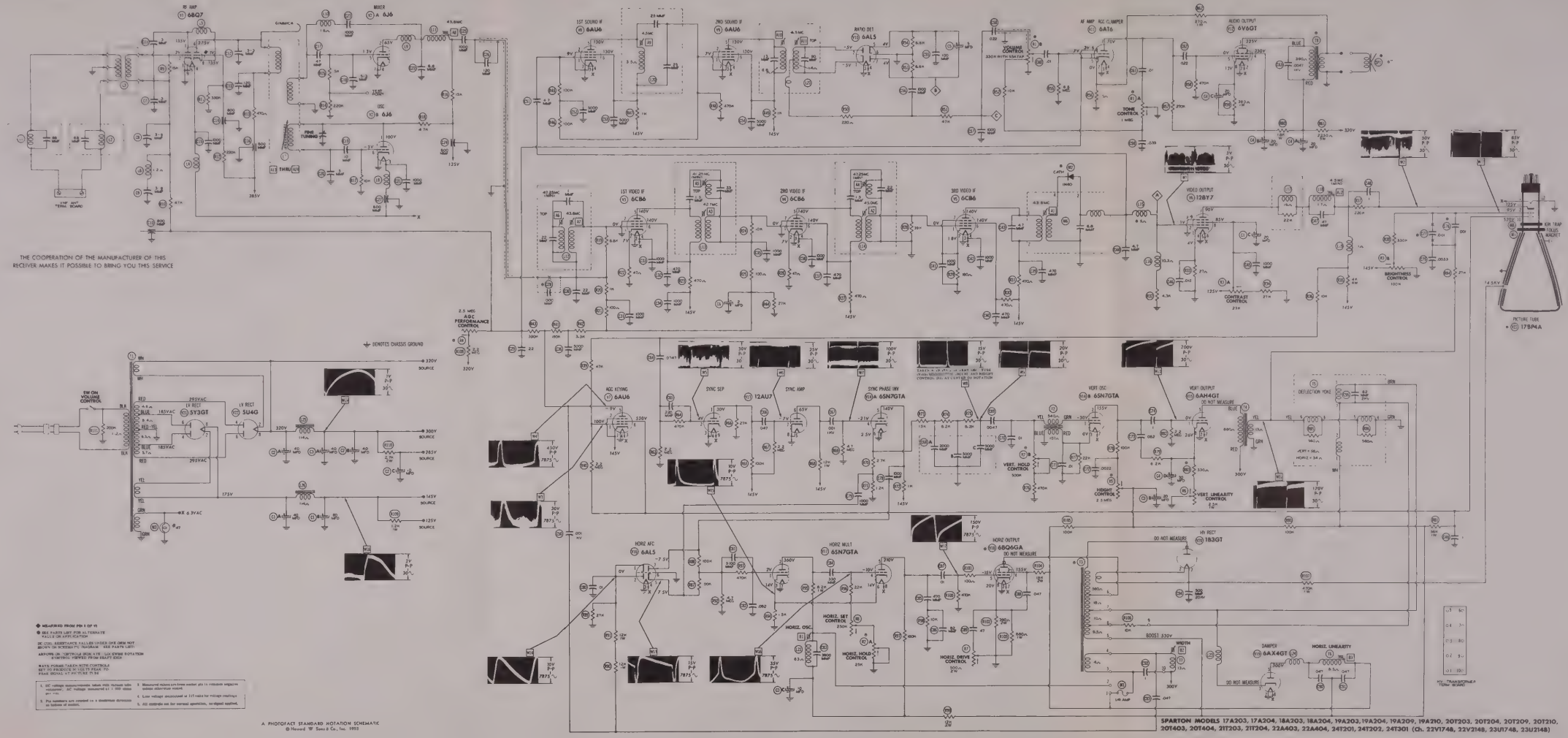
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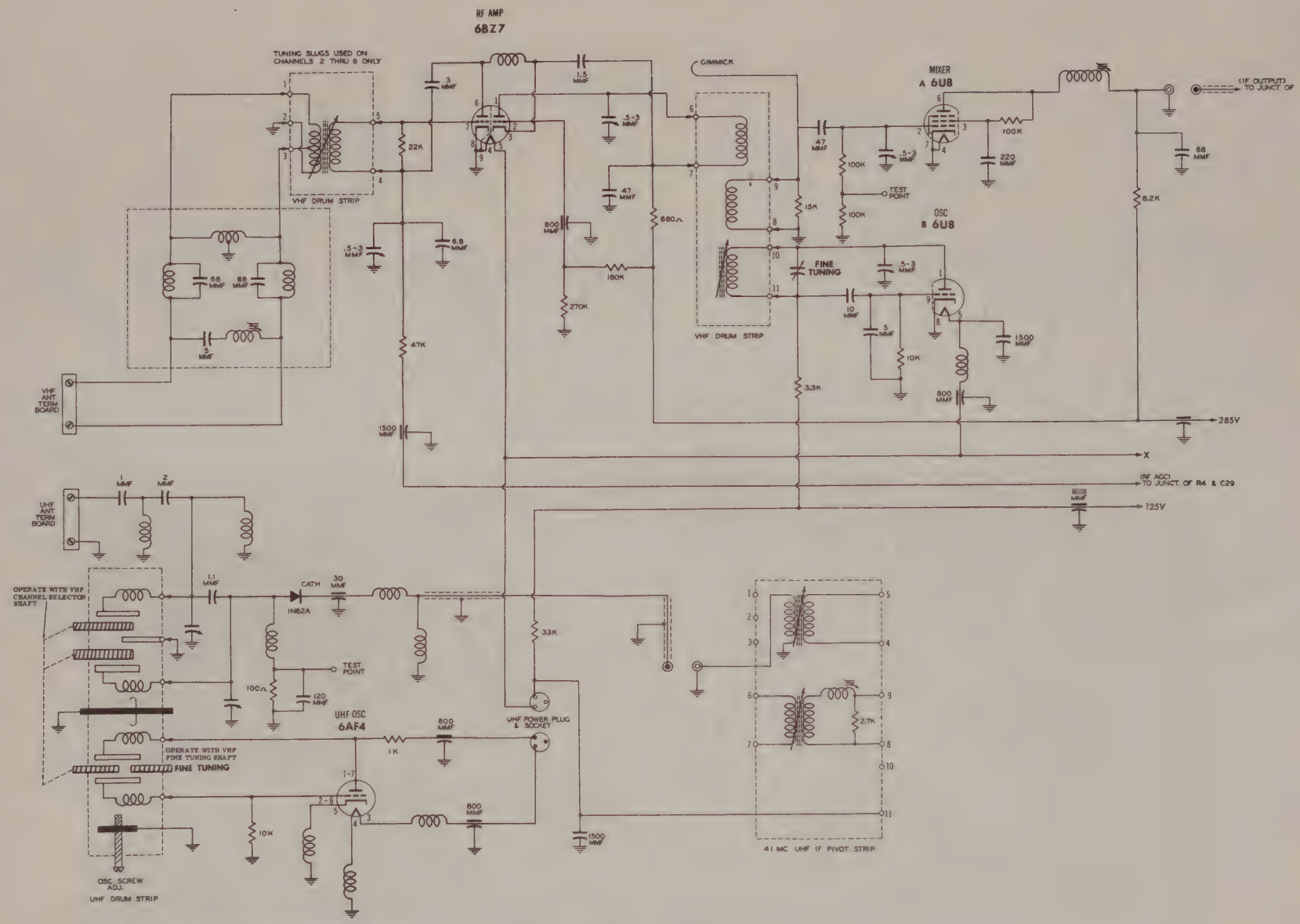
SPARTON MODELS 17A203, 17A204, 18A203, 18A204, 19A203, 19A204, 19A209, 19A210, 20T203, 20T204, 20T209, 20T210, 20T403, 20T404, 21T203, 21T204, 22A403, 22A404, 24T201, 24T202, 24T301 (Ch. 22V1748, 22V2148, 23U1748, 23U2148)



UHF-VHF TUNER PD 93179 USED ON CHASSIS 23U174B AND 23U214B

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ALTERNATE TUNER SCHEMATIC

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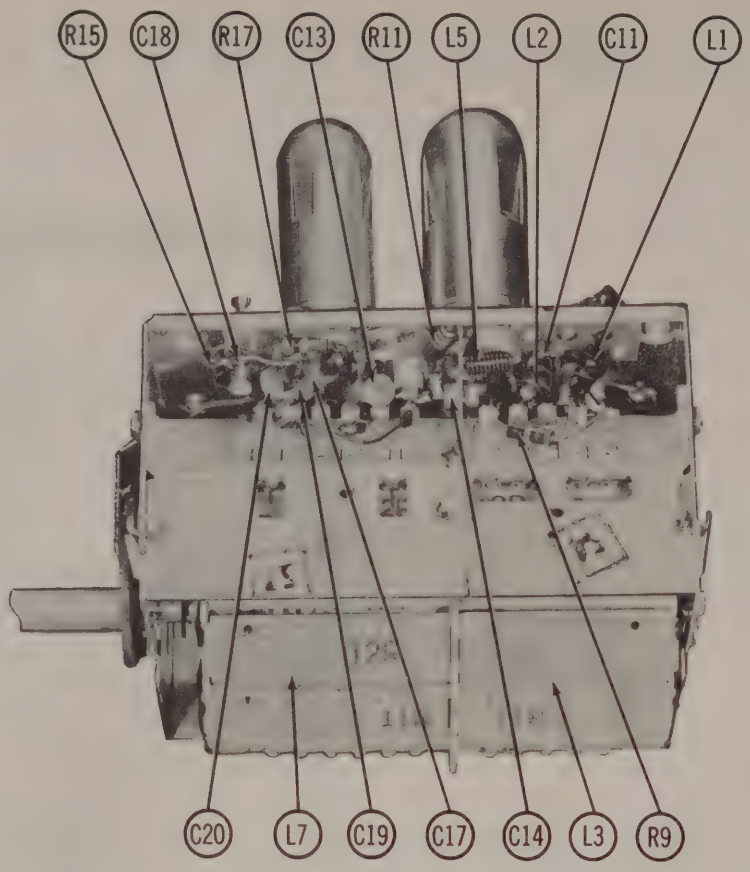
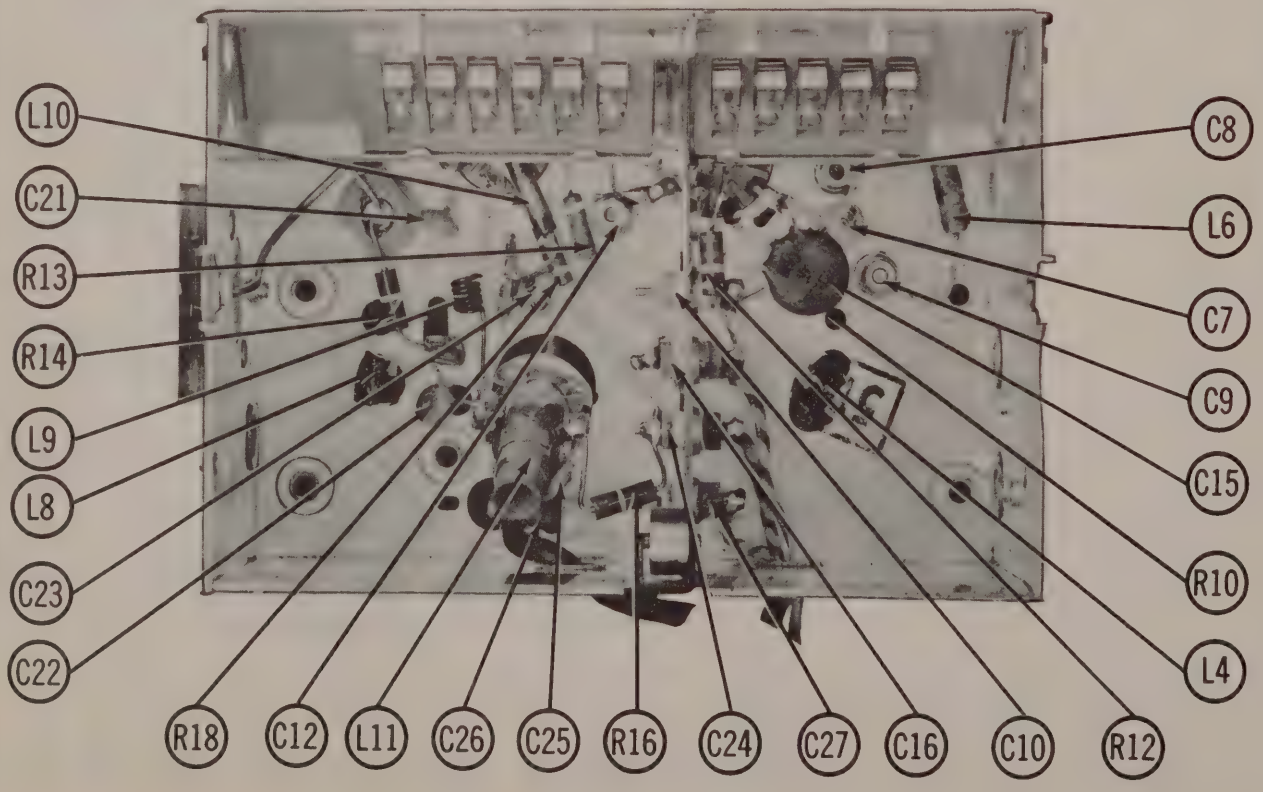


RF TUNER-RIGHT SIDE



RF TUNER-BOTTOM VIEW

SET 288 FOLDER 9

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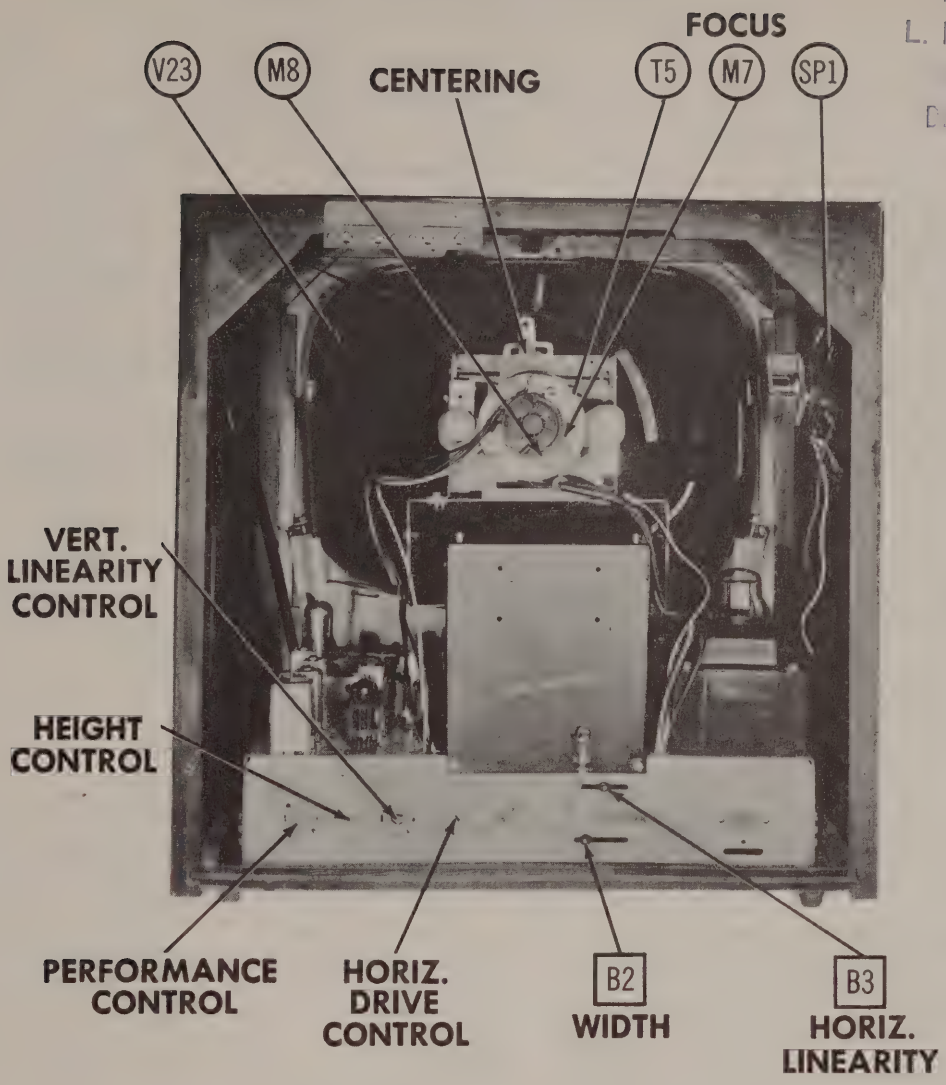

CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Tune in a TV station, preferably a test pattern.

Remove V16 (6AL5) from its socket and set the horizontal hold control fully counter clockwise.

Shunt L22 with a .1MFD, 400 volt capacitor from test point (terminal #2 on high voltage transformer) to chassis ground.

Adjust the horizontal set control (R8A) until the picture tends to float into horizontal sync.

Remove .1MFD capacitor across L22 and adjust the horizontal oscillator slug (B1) until the picture tends to float into horizontal sync.

Replace V16 (6AL5) in its socket.

Two or three diagonal bars should appear just before picture pulls into sync as horizontal hold control is turned toward its mid-range position.

Adjust the horizontal drive control (R7) clockwise as far as possible without the presence of vertical white lines or compression near the center of the picture.

Adjust the width slug (B2) for a picture slightly wider than necessary to fill the picture mask horizontally.

Adjust the horizontal linearity control (B3) for a picture that is symmetrical from left to right.

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage".

INSUFFICIENT SWEEP

Check by substitution V18, V19, V21 and V22. Check adjustments R7, B2, and B3. Check C85, C87, C92, R98, R102, R103, R104, T3, T5A and other associated components.

DRIVE LINES

Check by substitution V18 and V19. Check adjustments R7 and B3. Check C87, R104, T3, T5A and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V18 and V19. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines".

PIE CRUST EFFECT

Check by substitution V17, V18 and V19. Check C82 for open. Check L22, C81, R95 and other associated components.

XMAS TREE EFFECT

Check by substitution V17, V18 and V19. Check T3 and T5 for internal arcing. Check L22, C83, C80, C93, R90, R91 and other associated components.

VERTICAL

LOSS OF SWEEP

Check by substitution V14 and V15. Check waveform W10.

If Satisfactory	If Unsatisfactory
Check T4, T5B, C4D, R83 and other associated components.	Check T2, C71, C74, C72, R78, R80 and other associated components.

INSUFFICIENT SWEEP

Check by substitution V14 and V15. Check height and vertical linearity controls for proper operation. Check R78, T4 and other associated components.

COMPRESSED AT BOTTOM

Check by substitution V14 and V15. Check R80, R78, R5, C72, C74 and other associated components.

COMPRESSED AT TOP

Check by substitution V14 and V15. Check R83, R6, C4D, T4and other associated components.

FOLDS

Check by substitution V14 and V14. Check C73, C74, R79, R83, T4, T5B and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Substitute V13. Check C64, C65, C66, C67, R85, R68, R72 and other associated components.

LOSS OF VERTICAL SYNC-HORIZONTAL SYNC SATISFACTORY

Substitute V14. Check vertical integrator network. Check C69, C71, R76, R2B and other associated components.

LOSS OF HORIZONTAL SYNC-VERTICAL SYNC SATISFACTORY

Check by substitution V16 and V17. Check C78, C79, C81, C82, C83, L22, R95 and other associated components.

HORIZONTAL BENDING

Check by substitution V13, V14, V16 and V17. Check horizontal AFC network.

VIDEO

LOSS OF VIDEO

Substitute V6. Check C1C, R35, R33, R34, L19 and other associated components.

SOUND BARS(4. 5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check adjustment A12. Check video IF Alignment.

POOR CONTRAST

Substitute V6. Check L15, L17, C48, R37 and other associated components.

NEGATIVE PICTURE

Substitute V6. Check picture tube. Check video crystal detector network. Check C48, R37 and other associated components.

SMEAR

Substitute V6. Check L15, L16, L17, R37, C48 and other associated components.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V1, V3, V4, V5 and V6 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V8, V9, V10, V11 and V12. Check stages V11 and V12 using audio signal generator. Apply audio signal scross R1B.

If Satisfactory	If Unsatisfactory
Check ratio detector and audio IF stages for component failure or change of value.	Check C58, C60, C62, C63, C4C, R60, R61, R57, T8, speaker and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustment A-11 for minimum buzz. If still unsatisfactory, check audio IF alignment.

DISTORTED

Follow procedure outlined under "Weak or no Sound".

POWER

DEAD SET

If filaments fail to light, check AC interlock assembly. Check switch on volume control and T1. If filaments light, check by substitution V21 and V22. Check B+ filter and decoupling network.

SMALL AND/OR DIM PICTURE

Check by substitution V21 and V22. Check B+ filter and decoupling network.

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

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DENVER, COLORADO

ITEM No.	USE	REPLACEMENT DATA: SPARTON PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amp.	6BQ7	6BQ7	9AJ	
V2	Mixer-Osc.	6J6	6J6	7BF	
V3	1st. Video IF Amp.	6CB6	6CB6	7CM	
V4	2nd. Video IF Amp.	6CB6	6CB6	7CM	
V5	3rd. Video IF Amp.	6CB6	6CB6	7CM	
V6	Video Output	12BY7	12BY7	9BF	
V7	AGC Keying	6AU6	6AU6	7BK	
V8	1st. Sound IF Amp.	6AU6	6AU6	7BK	
V9	2nd. Sound IF Amp.	6AU6	6AU6	7BK	
V10	Ratio Det.	6AL5	6AL5	6BT	
V11	AF Amplifier-AGC Clamper	6AT6	6AT6	7BT	
V12	Audio Output	6V6GT	6V6GT		
V13	Sync Sep.-Sync Amp.	12AU7	12AU7	9A	
V14	Vert. Osc.-Sync Phase Inv.	6SN7GTA	6SN7GTA	8BD	
V15	Vert. Output	6AH4GT	6AH4GT	8EL	
V16	Horiz. AFC	6AL5	6AL5	6BT	
V17	Horiz. Mult.	6SN7GTA	6SN7GTA	8BD	
V18	Horiz. Output	6BQ6GA	6BQ6GA	6AM	6CU6 used as alternate
V19	Damper	6AX4GT	6AX4GT	4CG	
V20	HV Rectifier	1B3GT	1B3GT	3C	
V21	LV Rectifier	5Y3GT	5Y3GT	5T	
V22	LV Rectifier	5U4G	5U4G	5T	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA: SPARTON PART No.	CBS PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.	RETMA BASE TYPE	NOTES
V23	17BP4A	17BP4A	17BP4A	17BP4A	17BP4A	12N	① Aluminized
		17BP4B ①	17BP4B ①	17BP4B ③	17BP4B ①	12N	② Circuit changes necessary
				17BP4 ②			
	21ZP4B ①	21ZP4B ①	21ZP4B ①	21ZP4B ③	21ZP4B ①	12N	③ Silver screen
		21ZP4A	21ZP4A	21ZP4A	21ZP4A	12N	
				21ZP4 ②		12D	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: SPARTON PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C1A	■40	350	PA4307-34			FP375.6	TM-604020-350	T-110	
B	▲60	350							
C	▲20	200							
C2A	▲40	450	PA4307-35			FP376.8	TM-3094	T-165	
B	■40	450							
C	▲10	350							
C3A	▲40	475	PA4307-33			FP396.1	TM-4037	Q-480	
B	■20	475							
C	▲10	475							
C4A	▲20	450	PA4307-38			FP448	TM-4102	Q-395	
B	■20	400							
C	20	50							
D	▲50	50							
C5	5	50	PA4308-2			TC30	TD-5-50	MMT-0505	
C6	2	50	PA4303-14			TC302	TD-2-50	MMT-0505	
C7	3			TCZ-3R3	NP0A-3R3	ZT-5533			
C8	3-9			829-10					
C9	3-9			829-10					
C10	800								
C11	3			TCZ-3R3	NP0A-3R3	ZT-5533			
C12	.5-3			829-3	3115-01-0R5	CT565A			
C13	120			DD-121	GP2K-121	UC-5312			
C14	800								
C15	1000			DD-102	801-001	DC-521			
C16	800								
C17	47			DD-470	831-470	UC-5447			
C18	.5-3			829-3	3115-01-0R5	CT565A			
C19	10			TCZ-10	NP0K-100	ZT-541			
C20	5								
C21	1000			DD-102	801-001	DC-521			
C22	6.8			TCZ-6R8	NP0A-6R8	ZT-5568			
C23	1000			DD-102	801-001	DC-521			
C24	800								
C25	1000			DD-102	801-001	DC-521			
C26	120			D6-121	GP2K-121	UC-5312			
C27	800								
C28	1000		PA4334-6	DD-102	801-001	DC-521			Note 1
C29	.22	200	PC43GK-224			PT4022	IMP2-P22	3302022	
C30	22		CC34A-220F	TCZ-22	NP0K-220	ZT-5422		KR-1422	
C31	1000		PA4334-6	DD-102	801-001	DC-521		K-1210	
C32	470		PA4334-8	DD-471	831-471	UC-5347		K-1347	
C33	1000		PA4334-6	DD-102	801-001	DC-521		K-1210	
C34	1000		PA4334-6	DD-102	801-001	DC-521		K-1210	
C35	1000		PA4334-6	DD-102	801-001	DC-521		K-1210	
C36	5000		PA4334-1	DD-502	811-005	DC-525		C-1250	
C37	470		PA4334-8	DD-471	831-471	UC-5347		K-1347	
C38	1000		PA4334-6	DD-102	801-001	DC-521		K-1210	
C39	470		PA4334-8	DD-471	831-471	UC-5347		K-1347	
C40	470		PA4334-8	DD-471	831-471	UC-5347		K-1347	
C41	1000		PA4334-6	DD-102	801-001	DC-521		K-1210	
C42	1000		PA4334-6	DD-102	801-001	DC-521		K-1210	
C43	4.7		PA4328-11	TCZ-4R7	NP0A-4R7	ZT-555		KR-1550	
C44	4.7		PA4328-11	TCZ-4R7	NP0A-4R7	ZT-555		KR-1550	
C45	1000		PA4334-6	DD-102	801-001	DC-521		K-1210	
C46	.015	400	PC43FL-153	DD16-153		PT6115	IMP6-S15	3306115	
C47	47		CC30A-470F	TCZ-47	NP0-338-470	ZT-5447		KR-1447	
C48	.1	400	PC43GL-104	DF-104		PT401	IMP4-P1	330401	
C49	.1	600	PC43GM-104	DF-104		PT601	IMP6-P1	330601	

SPARTON MODELS 17A203, 17A204, 18A203, 18A204, 19A203, 19A204, 19A209, 19A210, 20T203, 20T204, 20T209, 20T210, 20T403, 20T404, 21T203, 21T204, 22A403, 22A404, 24T201, 24T202, 24T301 (Ch. 22V174B, 22V214B, 23U174B, 23U214B)

CAPACITORS (cont)

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA SPARTON PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C50	.001	1000	PC43GM-102	DD-102	IR5KV-102	PT1621	CT10-D1	2116-.001	
C51	4.7		PA4328-11	TCZ-4R5	NP0A-4R7	ZT-555		KR-1550	
C52	5000		PA4334-1	DD-502	811-005	DC-525		C-1250	
C53	5000		PA4334-1	DD-502	811-005	DC-525		C-1250	
C54	5000		PA4334-1	DD-502	811-005	DC-525		C-1250	
C55	100		HK36M-101	TCZ-100	NP0-337-101	ZT-531		KR-1310	
C56	1000		PA4334-6	DD-102	801-001	DC-521		K-1210	
C57	1000		HK36M-102	D6-102	GP2L-102	UC-521	IMP6-D1	K-1210	
C58	.022	400	PC43CL-223	DF-203	817-02	PT4122	IMP4-S22	3304122	
C59	.033	200	PC43GK-333	DF-303		PT6133	IMP6-S3	3306133	
C60	.01	400	PC43CL-103	D6-103	GP2-333-103	PT411	IMP4-S1	330411	
C61	.01	600	PC43GM-103	D6-103	GP2-333-103	PT611	IMP6-S1	330611	
C62	.022	600	PC43CM-223	DF-203	817-02	PT6122	IMP6-S22	3306122	
C63	.0047	1000	PC43GN-472	DD-472	IR5KV-472	PT16247	CT10-D47	2116-.005	
C64	.0047	400	PC43GL-472	DD-472	GP2-333-472	PT6247	IMP6-D47	3306247	
C65	220	500	MC60E-221	D6-221	GP2K-221	UC-5322		K-1322	
C66	.047	400	PC43GL-473	DF-503		PT4147	IMP4-S47	3304147	
C67	.001	1000	PC43GM-102	DD-102	IR5KV-102	PT1621	CT10-D1	2116-.001	
C68A	2000			DD-202	801-002	DC-522	IMP6-D2	C-1220	
B	5000		PA4339-4	DD-502	811-005	DC-525	IMP6-D5	C-1250	
C	5000			DD-502	811-005	DC-525	IMP6-D5	C-1250	
C69	.0047	400	PC43GL-472	D6-472	GP2-333-472	PT6247	IMP6-D47	3306247	
C70	.01	400	PC43FL-103	D6-103	GP2-333-103	PT411	IMP4-S1	330411	
C71	.01	400	PC43GL-103	D6-103	GP2-333-103	PT411	IMP4-S1	330411	
C72	.0022	600	PC42GM-222	D6-222	GP2-333-222	PT6222	IMP6-D22	3306222	
C73	.082	400	PC42FL-823					3306182	
C74	.1	400	PC42GL-104	DF-104		PT401	IMP4-P1	330401	
C75	.0033	600	PC43GL-332	D6-332	GP2-333-332	PT6233	IMP6-D33	3306233	
C76	.001	600		D6-102	GP2L-102	PT621	IMP6-D1	330621	Note 2
C77	.001	600		D6-102	GP2L-102	PT621	IMP6-D1	330621	Note 2
C78	1000	500	MC61E-102	D6-102	GP2L-102	MC255	IMP6-D1	K-1210	
C79	1000	500	MC61E-102	D6-102	GP2L-102	MC255	IMP6-D1	K-1210	
C80	.01	600	PC43FM-103	D6-103	GP2-333-103	PT611	IMP6-S1	330611	
C81	5100	500	MC61E-512			MCE465		CR-1251	
C82	.082	200	PC43FK-823					3306182	
C83	3900	500	MC63F-392			MCB463		CR-1239	
C84	330	500	MC60F-331	D6-331	811-331			KR-1333	
C85	470	500	MC60E-471	D6-471	811-471	MCB245		KR-1347	
C86	82	500	MC60G-820	TCZ-82	NP0-337-820			KR-1482	
C87	.01	600	PC42GM-103	D6-103	GP2-333-103	PT611	IMP6-S1	330611	
C88	.047	400	PC42GL-473	DF-503		PT4147	IMP4-S47	3304147	
C89	.47	200	PC43GK-474			PT4047	IMP2-P47	3302047	
C90	.047	600	PC42FM-473	DF-503		PT6147	IMP6-S47	3306147	
C91	.047	600	PC42FM-473	DF-503		PT6147	IMP6-S47	3306147	
C92	.1	200	PC43GK-104	DF-104		PT401	IMP2-P1	330201	
C93	.047	400	PC42GL-473	DF-503		PT4147	IMP4-S47	3304147	
C94	500	20000	PA4348	TV3-502	413				
C95	62	2000							

Note 1. Used only in models with UHF-VHF tuner.
Note 2. When C76 is .0022MFD, C77 is not used.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA SPARTON PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1Meg	½	PA-4428-3	▲QJ-736	RTV-472	F1-55	UF16L	Tone - Panel - Note 1
B	330KΩ	½				R2-38	UR354-T74 ♦	Volume - Tapped ⓐ 55KΩ-rear
C	Switch					KB-1	US-26	Attach to R1B
R1A	1Meg	½	PA-4450-5	*QJ-595	RTV-472	F1-55	UF16L	Tone - Panel
B	330KΩ	½				R2-38	UR354-T74	Volume-tapped ⓐ 60KΩ-rear
C	Switch					KB-2	US-27	Attach to R1B
R2A	25KΩ	½	PA-4477-1	▲▲QJ-737	RTV-516	F1-27	UF253L ■	Horiz. Hold-Panel-Note 2
B	500KΩ	½				R2-40	UR55L ■	Vert. Hold - Rear
R3A	25KΩ	½	PA-4457-2	**QJ-597	RTV-476	F1-27	UF253L †	Contrast - Panel
B	100KΩ	½				R2-31	UR15L †	Brightness - Rear
R4A	2.5Meg	½	PA-4454G	QU-239	A47-2.5Meg-S	BX-83	SU-565	AGC Performance - Note 3
B	Shaft		Not Req.	Not Req.	FKS-1/4	Not Req.	Not Req.	Attach to R4A
R5A	2.5Meg	½	PA-4472	QU-239	A47-2.5Meg-S	BX-83	SU-565	Height - Note 3
B	Shaft		Not Req.	Not Req.	FKS-1/4	Not Req.	Not Req.	Attach to R5A
R6	2500Ω	1	PC70024-4	WK-2500	39-3000		R2500L	Vert. Linearity - wirewound
R7	500Ω	2	PC70024-3	W-500	39-500		R500L	Horiz. Drive - wirewound
R8A	250KΩ	½	PA-4473	QU-130	A47-250K-S	AB-50	SU-46	Horiz. Set
B	Shaft		Not Req.	RQ	FKS-1/4	AK-1	Not Req.	Attach to R8A

Note 1. Some versions will use an alternate control part #PA-4450-5.
Note 2. Some versions will use an alternate control part #PA-4477.
Note 3. Some versions will use an alternate control part #PA-4454.
* CONCENTRIKIT EQUIVALENT - K-2 KIT, BASE ELEMENTS & SHAFTS: B11-137 & P1-200 (Panel) B18-132X & R1-212 (Rear) 76-2 SWITCH
** CONCENTRIKIT EQUIVALENT - K-2 KIT, BASE ELEMENTS & SHAFTS: B11-120 & P1-200 (Panel) B11-128 & R1-212 (Rear)
▲ CONCENTRIKIT EQUIVALENT - K-2 KIT, BASE ELEMENTS & SHAFTS: B11-137, P1-200 (Panel) B18-132X, R1-212 (Rear) 76-1 SWITCH
▲▲ CONCENTRIKIT EQUIVALENT- K-2 KIT, BASE ELEMENTS & SHAFTS: B11-120, P1-200 (Panel) B11-113, R1-212 (Rear)
† Universal replacement (Mallory exact duplicate part #UE-812).
■ Universal replacement (Mallory exact duplicate part #UE-816).
♦ Universal replacement (Mallory exact duplicate part #UE-1585S).

PARTS LIST AND DESC

RESIST

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA SPARTON PART No.	IRC PART No.	NOTES
R9	15KΩ			BTS-15K	
R10	47KΩ			BTS-47K	
R11	330KΩ			BTS-330K	
R12	220KΩ			BTS-220K	
R13	470Ω			BTS-470	
R14	220KΩ			BTS-220K	
R15	15KΩ			BTS-15K	
R16	15KΩ			BTS-15K	
R17	10KΩ			BTS-10K	
R18	4700Ω			BTS-4700	
R19	6800Ω 5%		BR12G-682	BTS-6800 5%	
R20	1000Ω		BR12N-102	BTS-1000	
R21	100Ω		BR12N-101	BTS-100	
R22	47Ω		BR12S-470	BTS-47	
R23	470Ω		BR12N-471	BTS-470	
R24	10KΩ 5%		BR12G-103	BTS-10K 5%	
R25	100Ω		BR12N-101	BTS-100	
R26	47Ω		BR12S-470	BTS-47	
R27	470Ω		BR12N-471	BTS-470	
R28	39KΩ 5%		BR12G-393	BTS-39K 5%	
R29	180Ω		BR12S-181	BTS-180	
R30	470Ω		BR12N-471	BTS-470	
R31	470Ω		BR12N-471	BTS-470	
R32	4300Ω 5%		BR12G-432	BTS-4300 5%	
R33	27Ω		BR12S-270	BTS-27	
R34	27KΩ		BR12S-273	BTS-27K	
R35	4000Ω	4	PA-4222	PW4-4000	
R36	10KΩ		BR12S-103	BTS-10K	
R37	220KΩ		BR12S-224	BTS-220K	
R38	330KΩ		BR12S-334	BTS-330K	
R39	47KΩ		BR12S-473	BTS-47K	
R40	2.2Meg		BR12S-225	BTS-2.2Meg	
R41	180KΩ 5%		BR12G-184	BTS-180K 5%	
R42	3300Ω		BR12N-332	BTS-3300	
R43	390KΩ 5%		BR12S-394	BTS-390K 5%	
R44	27KΩ 5%		BR12G-273	BTS-27K 5%	
R45	100KΩ		BR12N-104	BTS-100K	
R46	100KΩ		BR12N-104	BTS-100K	
R47	1000Ω		BR12N-102	BTS-1000	
R48	470KΩ		BR12S-474	BTS-470K	
R49	1000Ω		BR12N-102	BTS-1000	
R50	220Ω 5%		BR12G-221	BTS-220 5%	
R51	47KΩ		BR12S-473	BTS-47K	
R52	10KΩ		BR12S-103	BTS-10K	
R53	6800Ω 5%		BR12G-682	BTS-6800 5%	
R54	6800Ω 5%		BR12G-682	BTS-6800 5%	
R55	6.8Meg		BR12N-685	BTS-6.8Meg	
R56	10Ω		BR12S-100	BTS-10	
R57	270KΩ		BR12S-274	BTS-270K	
R58	470KΩ		BR12N-274	BTS-470K	
R59	390Ω	1	CR12S-391	BTA-390	
R60	1800Ω 5%	1	BR12S-182	BTA-1800 5%	

Note 1. Some versions use a 56

TRANSFORM

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	SPARTON PART No.	Halldors PART N
T1	117VAC ⓐ1.66A	600VCT .140ADC tap ⓐ 380VCT .072ADC	5VAC ⓐ 2A	AB44040-1 AB44039-1 ①	
	SEC. 3	SEC. 4	SEC. 5		
	5VAC ⓐ3A	6.3VAC ⓐ9.3A			

① Alternate power transformer.

TRANSFORMERS (S

ITEM No.	USE	SPARTON PART No.	Halldorson PART No.	Merit PART No
T2	Vert. Osc. Trans.	AB47014-1	B6700	A-3000
T3	Horiz. Output Trans.	PC70030-1 PC70030 ②	FB411 & RF800 *①	HVO-21 ①
T4	Vert. Output Trans.	AB44072-1	Z1803	A-3036
T5A	Yoke-Horiz. (21MH)	PC70031 ④	DF605 ③	MDF-73
B	Vert. (40MH)			
T6	Horiz. Lin. Coil (.8-6MH)	AA6400-6	RF800⑤⑥	MWC-6
T7	Width Coil (3.4-21.5MH)	AA6400-10	RF800⑤⑧	MWC-1 ⑨

① Drill new mounting hole(s).
② Alternate horizontal output transformer.
③ Use original horizontal yoke damping network.
④ Includes capacitor C95, resistors R85 and R86.
⑤ Drill new mounting hole or use original slider and core.
⑥ Connect to terminals #3 and #4.
⑦ Connect to coded blue and green terminals.
⑧ Connect to terminals #1 and #2.
⑨ Connect to coded red and blue terminals.

PROPERTY OF

PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS (cont)

ITEM No.	RATING CAP.	RATING VOLT	SPARTON PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C50	.001	1000	PC43GM-103	DD-102	IR5KV-102	PT5E21	CT10-D1	21D5-.001	
C51	4.7		PA4328-11	TCE-4R5	MPGA-4R7	ET-555		K5K-1550	
C52	5000		PA4334-1	DD-502	5U-005	DC-525		C-1250	
C53	5000		PA4334-1	DD-502	5U-005	DC-525		C-1250	
C54	5000		PA4334-1	DD-502	5U-005	DC-525		C-1250	
C55	100		HR36M-101	TCE-100	NPO-101	ET-531		KR-1310	
C56	1000		PA4334-6	DD-102	5U-001	DC-521		K-1210	
C57	1000		HR36M-102	DD-102	GP5L-102	UC-531	IMP5-D1	K-1210	
C58	.022	400	PC43CL-223	DF-203	417-09	PT4123	IMP4-S23	3304123	
C59	.033	200	PC43CK-333	DF-303		PT4133	IMP5-S3	3304133	
C60	.01	400	PC43CL-103	DE-103	GP2-333-103	PT411	IMP4-S1	330411	
C61	.01	600	PC43GM-103	D6-103	GP2-333-103	PT611	IMP6-S1	33061	
C62	.022	600	PC43CM-223	DF-203	417-09	PT6123	IMP6-S23	3306123	
C63	.0047	1000	PC43GN-472	DD-472	IR5KV-472	PT5E247	CT10-D47	21D5-.005	
C64	.0047	400	PC43CL-472	DD-472	GP2-333-472	PT2247	IMP6-D47	3306247	
C65	220	500	MC90E-221	D6-221	GP3E-331	PT5E233		K-1321	
C66	047	400	PC43CL-473	DF-503		PT4147	IMP4-S47	3304147	
C67	.001	1000	PC43GM-103	DD-102	IR5KV-103	PT5E21	CT10-D1	21D5-.001	
C68A	.0002			DD-202	5U-002	DC-522	IMP6-D2	C-1230	
B	5000		PA4339-4	DD-502	5U-005	DC-525	IMP6-D5	C-1250	
C	5000			DD-502	5U-005	DC-525	IMP6-D5	C-1250	
C69	.0047	400	PC43GL-473	D6-473	GP2-333-473	PT6247	IMP6-D47	3306247	
C70	.01	400	PC43FL-103	D6-103	GP2-333-103	PT411	IMP4-S1	330411	
C71	.01	400	PC43CL-103	D6-103	GP2-333-103	PT411	IMP4-S1	330411	
C72	.0022	600	PC43GM-322	D6-322	GP3-333-322	PT6222	IMP6-D22	3306222	
C73	.062	400	PC43FL-623					3306623	
C74	.1	400	PC43GL-104	DF-104		PT401	IMP4-P1	330401	
C75	.0033	600	PC43GL-332	D6-332	GP2-333-332	PT6233	IMP6-D33	3306233	
C76	.001	600		D6-102	GP2L-102	PT621	IMP6-D1	330621	Note 2
C77	.001	600		D6-102	GP2L-102	PT621	IMP6-D1	330621	Note 2
C78	1000	500	MC81E-102	D6-102	GP2L-102	MC255	IMP6-D1	K-1210	
C79	1000	500	MC81E-102	D6-102	GP2L-102	MC255	IMP6-D1	K-1210	
C80	.01	600	PC43FM-103	D6-103	GP2-333-103	PT611	IMP6-S1	330611	
C81	5100	500	MC81E-512			MC256S		CR-1251	
C82	.082	200	PC43FK-823					3306182	
C83	3900	500	MC63F-392				MCD463	CR-1239	
C84	330	500	MC63F-331	D6-331	5U-331			KR-1333	
C85	470	500	MC50E-471	D6-471	5U-471	MCB546		KR-1347	
C86	82	500	MC90E-820	TCE-53	NPO-820			KR-1682	
C87	.01	600	PC42GM-103	D6-103	GP2-333-103	PT611	IMP6-S1	330611	
C88	.047	400	PC42GL-473	DF-503		PT4147	IMP4-S47	3304147	
C89	.47	200	PC43GK-474			PT6547	IMP2-P47	3302947	
C90	.047	600	PC42FM-473	DF-503		PT6147	IMP6-S47	3306147	
C91	.047	600	PC42FM-473	DF-503		PT6147	IMP6-S47	3306147	
C92	.1	200	PC43GK-104	DF-104		PT401	IMP2-P1	330901	
C93	.047	400	PC42GL-473	DF-503		PT4167	IMP4-S47	3304147	
C94	500	20000	PA4348	TVS-503	413				
C95	62	2000							

Note 1. Used only in models with UHF-VHF tuner.
Note 2. When C78 is .0022MFD, C77 is not used.

CONTROLS

ITEM No.	RATING RESIST.	RATING WATTS	SPARTON PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1Meg		PA-4428-3	▲QJ-736	RTV-472	F1-55	UF16L	Tone - Panel - Note 1
B	330KΩ					R2-38	UR354-274	Volume - Tapped @ 55KΩ-rear
C	Switch					KB-1	US-36	Attach to R1B
R1A	1Meg		PA-4450-5	*QJ-596	RTV-472	F1-55	UF16L	Tone - Panel
B	330KΩ					R2-38	UR354-274	Volume-Tapped @ 60KΩ-rear
C	Switch					KB-2	US-37	Attach to R1B
R2A	25KΩ		PA-4477-1	▲▲QJ-737	RTV-518	F1-27	UF25SL	Horiz. Hold-Panel-Note 2
B	500KΩ					R2-40	UR16L	Vert. Hold - Rear
R3A	25KΩ		PA-4457-2	**QJ-597	RTV-476	F1-27	UF25SL	Contrast - Panel
B	100KΩ					R2-31	UR16L	Brightness - Rear
R4A	2.5Meg		PA-4454G	QU-259	A47-2.5Meg-B	BK-83	SU-565	AGC Performance - Note 3
B	Shaft		Not Req.	Not Req.	FKS-1/4	Not Req.	Not Req.	Attach to R4A
R5A	2.5Meg		PA-4473	QU-238	A47-2.5Meg-B	BK-83	SU-565	Height - Note 3
B	Shaft		Not Req.	Not Req.	FKH-1/4	Not Req.	Not Req.	Attach to R5A
R6	2500Ω		PC70034-4	WK-2500	39-2000		R2500L	Vert. Linearity - wirewound
R7	500Ω		PC70034-3	W-500	38-500		R500L	Horiz. Drive - wirewound
R8A	350KΩ		PA-4473	QU-130	A47-250K-B	AB-50	SU-46	Horiz. Set
B	Shaft		Not Req.	RQ	FKS-1/4	AK-1	Not Req.	Attach to R8A

Note 1. Some versions will use an alternate control part #PA-4450-5.
Note 2. Some versions will use an alternate control part #PA-4477.
Note 3. Some versions will use an alternate control part #PA-4454.
* CONCENTRIKIT EQUIVALENT - K-3 KIT. BASE ELEMENTS & SHAFTS: Bil-137 & Pl-200 (Panel) Bil8-132X & Rl-212 (Rear) T6-2 SWITCH

** CONCENTRIKIT EQUIVALENT - K-2 KIT, BASE ELEMENTS & SHAFTS: Bil-120 & Pl-200 (Panel) Bil-128 & Rl-212 (Rear)

▲ CONCENTRIKIT EQUIVALENT - K-3 KIT, BASE ELEMENTS & SHAFTS: Bil-137, Pl-200 (Panel) Bil8-132X, Rl-212 (Rear) T6-1 SWITCH

▲▲ CONCENTRIKIT EQUIVALENT- K-2 KIT, BASE ELEMENTS & SHAFTS: Bil-120, Pl-200 (Panel) Bil-113, Rl-212 (Rear)

† Universal replacement (Mallory exact duplicate part #UE-813).
■ Universal replacement (Mallory exact duplicate part #UE-816).
♦ Universal replacement (Mallory exact duplicate part #UE#1585B).

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	SPARTON PART No.	IRC PART No.	NOTES
R9	15KΩ	½		BTS-15K	
R10	47KΩ	½		BTS-47K	
R11	330KΩ	½		BTS-330K	
R12	220KΩ	½		BTS-220K	
R13	470Ω	½		BTS-470	
R14	330KΩ	½		BTS-330K	
R15	15KΩ	½		BTS-15K	
R16	15KΩ	½		BTS-15K	
R17	10KΩ	½		BTS-10K	
R18	4700Ω	½		BTS-4700	
R19	68000Ω 5%	½	BR12C-683	BTS-6800 5%	
R20	1000Ω	½	BR12N-102	BTS-1000	
R21	330KΩ	½	BR12N-331	BTS-330K	
R22	470KΩ	½	BR12S-470	BTS-47	
R23	470Ω	½	BR12N-471	BTS-470	
R24	10KΩ 5%	½	BR12C-103	BTS-10K 5%	
R25	100Ω	½	BR12N-101	BTS-100	
R26	47Ω	½	BR12S-470	BTS-47	
R27	470Ω	½	BR12N-471	BTS-470	
R28	39KΩ 5%	½	BR12C-393	BTS-39K 5%	
R29	180Ω	½	BR12N-181	BTS-180	
R30	470Ω	½	BR12N-471	BTS-470	
R31	470Ω	½	BR12N-471	BTS-470	
R32	43000Ω 5%	½	BR12C-433	BTS-4300 5%	
R33	27Ω	½	BR12S-270	BTS-27	
R34	27KΩ	½	BR12S-273	BTS-27K	
R35	4000Ω	4	PA-4322	PW4-4000	
R36	10KΩ	½	BR12S-103	BTS-10K	
R37	220KΩ	½	BR12N-224	BTS-220K	
R38	330KΩ	½	BR12N-334	BTS-330K	
R39	47KΩ	½	BR12S-473	BTS-47K	
R40	2.2MEG	½	BR12N-225	BTS-2.2Meg	
R41	180KΩ 5%	½	BR12C-184	BTS-180K 5%	
R42	3300Ω	½	BR12N-332	BTS-3300	
R43	390KΩ 5%	½	BR12N-394	BTS-390K 5%	
R44	27KΩ 5%	½	BR12C-273	BTS-27K 5%	
R45	5.6Meg	½	BR12N-564	BTS-5.6Meg	
R46	100KΩ	½	BR12N-104	BTS-100K	
R47	1000Ω	½	BR12N-102	BTS-1000	
R48	470KΩ	½	BR12N-474	BTS-470K	
R49	1000Ω	½	BR12N-102	BTS-1000	
R50	2200Ω 5%	½	BR12C-222	BTS-2200 5%	
R51	47KΩ	½	BR12S-473	BTS-47K	
R52	10KΩ	½	BR12S-103	BTS-10K	
R53	6800Ω 5%	½	BR12C-682	BTS-6800 5%	
R54	68000Ω 5%	½	BR12C-683	BTS-6800 5%	
R55	5.6Meg	½	BR12N-565	BTS-5.6Meg	
R56	10Ω	½	BR12S-100	BTS-10	
R57	270KΩ	½	BR12N-274	BTS-270K	
R58	470KΩ	½	BR12N-474	BTS-470K	
R59	39Ω	1	CR12S-391	BTA-390	
R60	1800Ω 5%	1	BR12S-182	BTS-1800 5%	

Note 1. Some versions use a 680Ω resistor in this application.

ITEM No.	RATING OHMS	RATING WATT	SPARTON PART No.	IRC PART No.	NOTES
R61	2250Ω	5	PA4300-32		
R62	270Ω	1		BTA-270	
R63	2.2Meg	½	BR12N-235	BTS-2.2Meg	
R64	470KΩ	½	BR12S-474	BTS-470K	
R65	100KΩ	½	BR12S-104	BTS-100K	
R66	27KΩ	½	BR12S-273	BTS-27K	
R67	2.2Meg	½	BR12N-225	BTS-2.2Meg	
R68	10KΩ	1	CR12A-103	BTA-10K	
R69	4.7Meg	½	BR12S-475	BTS-4.7Meg	
R70	27000Ω 5%	½	BR12C-273	BTS-2700 5%	
R71	1200Ω 5%	½	BR12C-122	BTS-1200 5%	
R72	10000Ω 5%	½	BR12C-103	BTS-1000 5%	
R73	15KΩ	½	BR12S-153	BTS-15K	
R74	8200Ω	½	BR12S-822	BTS-8200	
R75	8200Ω	½	BR12S-822	BTS-8200	
R76	470KΩ 5%	½	BR12C-474	BTS-470K 5%	
R77	22KΩ	½	BR12S-223	BTS-22K	
R78	100KΩ	½	BR12S-104	BTS-100K	
R79	8200Ω 5%	½	BR12C-822	BTS-8200 5%	
R80	100KΩ	½	BR12S-104	BTS-100K	
R81	560Ω	1	CR12S-563	BTA-56K	
R82	2.2Meg	½	BR12N-225	BTS-2.2Meg	
R83	330Ω	½	BR12N-331	BTS-330	
R84	27KΩ	½	BR12S-273	BTS-27K	
R85	560Ω	½		BTS-560	
R86	560Ω	½		BTS-560	
R87	100KΩ 5%	½	BR12C-104	BTS-100K 5%	
R88	100KΩ 5%	½	BR12C-104	BTS-100K 5%	
R89	27KΩ	½	BR12S-273	BTS-27K	
R90	12KΩ	1	CR12S-123	BTA-12K	
R91	12KΩ	1	CR12S-123	BTA-12K	
R92	4.7Meg	½	BR12N-475	BTS-4.7Meg	
R93	470KΩ	½	BR12S-474	BTS-470K	
R94	1500Ω 5%	½	BR13C-152	BTS-1500 5%	
R95	6200Ω 5%	1	CR12C-622	BTA-6200 5%	
R96	22KΩ	½	BR12S-223	BTS-22K	
R97	180KΩ 5%	½	BR12C-184	BTS-180K 5%	
R98	10KΩ	½	BR12S-103	BTS-10K	
R99	12KΩ	½	BR12S-123	BTS-12K	
R100	470KΩ	½	BR12N-474	BTS-470K	
R101	100Ω 5%	½	BR12C-101	BTS-100 5%	
R102	390Ω	½	DR12N-391	BTS-390	
R103	680Ω	1	CR12S-681	BTA-680	
R104	18KΩ	½	DR12S-183	BTS-18K	
R105	100KΩ	½	BR12S-104	BTS-100K	
R106	10KΩ	½	BR12N-103	BTS-10K	
R107	470KΩ	1	CR11N-474	BTA-470K	
R108	2.2MEG	½	BR12S-225	BTS-2.2Meg	
R109	1200Ω	1	CR12S-122	BTA-1200	
R110	2700Ω	2	DR12S-272	BTB-2700	
R111	200KΩ 5%	½	BR12N-234	BTS-200K 5%	

TRANSFORMER (POWER)

ITEM No.	RATING PRI	RATING SEC 1	RATING SEC 2	SPARTON PART No.	Halloran PART No	Merit PART No	RCA TYPE No	Stancor PART No	Thordarson PART No	Triad PART No
T1	117VAC ①1.66A	600VCT ⑤ .140ADC tap ⑥ 390VCT 072ADC	5VAC ⑤ 2A	AB44040-1 AB44039-1 ①		P-2831				
	SEC 3	SEC 4	SEC 5							
	5VAC ⑤3A	6.3VAC ⑤3A								

① Alternate power transformer.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	SPARTON PART No	Halloran PART No	Merit PART No	RCA PART No	Ram PART No	Stancor TYPE No	Thordarson PART No	Triad PART No
T2	Vert. Osc. Trans.	AB47014-1	B6700	A-3000	209T1	V40S ⑦	A-6111	24A81	A-85X
T3	Horiz. Output Trans.	PC70030-1	FD41L & FD41K ②	HVO-21 * ①	232T1 *①	X09S *①	A-8255 * ①	FLY-28 * ①	D-35 *①
T4	Vert.Output Trans.	AB44072-1	Z1803	A-3036	294T2 ①	V30T ①	A-8144 ①	26S51	A-99X ①
T5A	Yoke-Horiz.(DIMEN Vert.(40MH)	PC70031 ④	DF805 ②	MDF-73 ②	222D1 ③	Y70F20, 43 ③	DY-11A ③	Y-18 ③	
T6	Horiz. Lin. Coil (.8-6MH)	AA6406-6	RF800 ⑩⑫	MWC-6 ⑤	213R1 ⑤	201R15 ⑤	WC-8 ⑤	WC-22	WC-12 ⑤ ⑦
T7	Width Coil (3.4-21.5MH)	AA6400-10	RF800 ⑩⑫	MWC-10 ⑤ ⑦	215R1 ⑤	201R16 ⑤	WC-5 ⑤ ⑦	WC-18 ⑤	WC-12 ⑤ ⑦

① Drill new mounting hole(s).
② Alternate horizontal output transformer.
③ Use original horizontal yoke damping network.
④ Includes capacitor C95, resistors R85 and R88.
⑤ Drill new mounting hole or use original slider and core.
⑥ Connect to terminals #3 and #4.
⑦ Connect to coded blue and green terminals.
⑧ Connect to terminals #1 and #2.
⑨ Connect to coded red and blue terminals.

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

ORIGINAL TERMINAL CONNECTIONS	Halldorson Replacement Connections	Merit Replacement Connections	RCA Replacement Connections	Ram Replacement Connections	Stancor Replacement Connections	Thordarson Replacement Connections	Triad Replacement Connections
6	9	5	10	1	5	1	III
7	5	2	8	3	4	3	8
8	See Note ⑪	6	See Note ⑪	T	See Note ⑪	T	See Note ⑪
9	1	1	3	4	1	4	7
4	Term. #3 of RF800	8	2	5	7	5	2
3	See Note ⑪	7	7	8	7	8	4
Connect Width Coil Across	#4 & #10	Term. #1 & #2 of RF800 across "T" & #1	#8 & junction C92 & B+	#5 & junction C92 & B+	#7 & junction C92 & B+	#5 & junction C92 & B+	#2 & junction C92 & B+
Special Notes	⑩ ⑪	⑩	⑩	⑩	⑩	⑩ ⑫	⑫

⑩ Connect R106 in series with C95 across terminals #3 and #7 of yoke.
⑪ Remove original width coil and capacitor C92. Connect original terminal #10 connection (B+) to original terminal #3 connection (fuse). Connect terminal #4 of RF800 to chassis ground. If the picture is out of phase, reverse RF800 primary or secondary.
⑫ Jumper terminals #9 and "T".

TRANSFORMER (AUDIO OUTPUT)

ITEM No	IMPEDANCE PRI	IMPEDANCE SEC	SPARTON PART No.	Halldorson PART No.	Merit PART No	Stancor PART No	Thordarson PART No	Triad PART No	NOTES
T8	6.8KΩ	4.4Ω	AB44081-5 AB44081-6 ①	Z1003	A-3020	A-3849	24S81	S-92	① Alternate audio output transformer.

SPEAKER

ITEM No.	RATINGS SIZE	RATINGS FIELD	RATINGS V C IMP	SPARTON PART No	QUAM PART No	NOTES
SP1	6"	PM	4.4Ω	PC63000-52A ①	6A1	① Used in models 247201, 247202, 247301, 307203, 207204, 207205, 217203, 217204, 217205 and 217206
	10"	PM	4.4Ω	PC63000-50-56 ②	10A31	② Used in models 17A303, 17A304, 18A303, 18A204, 22A403 & 22A404.
	12"	PM	4.4Ω	PC63000-53 ③	12A31	③ Used in models 18A203 and 18A204.
	4"	PM		PC63006-56 ④		④ Used as tweeter.

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	SPARTON PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	IF Trap	0Ω						Wound on 68MMF cap.
L2	IF Trap	0Ω						Wound on 68MMF cap.
L3	Ant. Coils	0Ω CT	0Ω					
L4	Fil. Choke	0Ω						
L5	Neut. Coil	0Ω						
L6	IF Trap	1.2Ω						
L7	RF, Mixer Grid & Osc. Coils	0Ω						
L8	Fil. Choke	0Ω						
L9	RF Coil	0Ω						
L10	Feedback Coil	1.6Ω						
L11	Conv. Plate	.3Ω						
L12	1st. Video IF	.1Ω		AB43095-4				Includes 47.25MC trap
L13	2nd. Video IF	.2Ω	.3Ω	AB43095-5				Includes 41.25MC Trap
L14	3rd. Video IF	.2Ω	.3Ω	AB43095-6				
L15	Series Peaking Coil	6.3Ω		AA6613-13	13-1200	TV-101	6111	99 Microhenries
L16	Shunt Peaking Coil	10.3Ω		AA6613-11	13-1260	TV-105	6151	248 Microhenries
L17	Series Peaking Coil	16Ω		AA6403-9	13-1300 ■		6174 ■	529 Microhenries, wound on 22KΩ resistor
L18	4.5MC trap	1.7Ω		AA6407-1	20-1204	TV-121	1469	
L19	Shunt Peaking Coil	11Ω		AA6613-12	13-1290	TV-125	6130	372 Microhenries
L20	Sound IF	2.5Ω		AB43090-7				Includes cape.
L21	Ratio Det.	6.8Ω	1.4DCT	AB43080-6	17-1497	TV-115	6206	Tertiary winding - .7Ω
L22	Horiz. Osc.	63Ω		AA6403-3	13-1578	TV-103	6210	
L23	RF Choke	.4Ω		AA6650-8	19-1003		4606	3.3 Microhenries
L24	RF Choke	.4Ω		AA6650-8	19-1003		4606	3.3 Microhenries

■ Parallel with 22KΩ resistor.

FILTER CHOKE

ITEM No	RATINGS TOTAL DIRECT CURRENT	RATINGS D C. RESISTANCE	RATINGS INDUCTANCE @ CURRENT (000 ^c/s)	SPARTON PART No.	Halldorson PART No	Merit PART No	Stancor PART No	Thordarson PART No	Triad PART No
L25	.140ADC	114Ω	5HY	AB47008-3	C5028 ①		C-2304 ①		C-13X ①
L26	.074ADC	114Ω	5HY	AB47008-3	C5028 ①		C-2304 ①	20C65	C-13X ①

① Drill one new mounting hole.

SPARTON MODELS 17A203, 17A204, 18A203, 18A204, 19A203, 19A204, 19A209, 19A210, 207203, 207204, 207209, 207210, 207403, 207404, 217203, 217204, 22A403, 22A404, 247201, 247202, 247301 (CH. 23V1748, 23V1749, 23U1748, 23U1749)

PARTS LIST AND DESCRIPTIONS (Continued)

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			SPARTON PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG P/T	1/4A 250V			318.250 (3AG P/T 1/4A)		GJV 1/4	

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA		NOTES
		SPARTON PART No.	SYLVANIA PART No.	
M2	1N60 *		1N60	Video Detector

* Some versions may use 1N64 crystal diode in this application.

MISCELLANEOUS

ITEM No.	PART NAME	SPARTON PART No.	NOTES
M3	Dial Light		#47
M4	Tuner	PD92102	VHF - Chassis 22V174B, 22V214B
M5	Tuner	PD93179	VHF-UHF - Chassis 23U174B, 23U214B
M6	Video Det. Assy.	AA6833-2	Includes M2, coils and cap.
M7	Focus Magnet	PC70029	Includes centering device
M8	Ion trap	PA1248-5	Chassis 22V174B, 23U174B
	Ion trap	PA1248-6	Chassis 22V214B, 23U214B
	Cabinet	PD90169-2	Models 20T210, 24T201, 24 T202
	Cabinet	PD90169-3	Model 24T301
	Cabinet	PD90176-2	Models 17A203, 17A204
	Cabinet	PD90180-2	Models 18A203, 18A204
	Cabinet	PD90179-2	Models 19A203, 19A204
	Cabinet	PD90178-2	Models 20T203, 20T204, 21T203, 21T204
	Cabinet	PD90178-4	Models 20T403, 20T404
	Cabinet	PD90177-4	Models 22A403, 22A404
	Knob	PA5660-3	Horiz. Hold, contrast,tone - Model 20T210
	Knob	PA5660-1	Horiz. Hold, contrast - Models 24T201, 24T202, 17A203, 17A204, 18A203, 18A204, 19A203, 19A204, 20T203, 20T204, 21T203, 21T204
	Knob	PA5660-2	Horiz. Hold, & contrast - Models 24T301, 20T403, 20T404, 22A403, 22A404
	Knob	PA5669-1	Vert. Hold - Models 20T210, 24T201, 24T202, 17A203, 17A204, 18A203, 18A204, 19A203, 19A204, 20T203, 20T204, 21T203, 21T204
	Knob	PA5669-2	Vert. Hold - Models 24T301, 20T403, 20T404, 22A403, 22A404
	Knob	PA5670-1	Brightness - Models 20T210, 24T201, 24T202, 17A203, 17A204, 18A203, 18A204, 19A203, 19A204, 20T203, 20T204, 21T203, 21T204
	Knob	PA5670-2	Brightness - Models 24T301, 20T403, 20T404, 22A403, 22A404
	Knob	PA5671-1	On-off-volume - Model 20T210
	Knob	PB40638-1	On-off-volume - Models 24T201, 17A203, 18A203, 19A203, 20T203, 21T203
	Knob	PB40638-2	On-off-volume - Models 24T301, 20T403, 22A403,
	Knob	PB40635-1	On-off-volume - Models 24T202, 17A204, 18A204, 19A204, 20T204, 21T204
	Knob	PB40635-2	On-off-volume - Models 20T404, 22A404
	Knob	PB40634	Tone - Models 24T201, 24T301, 17A203, 18A203, 19A203, 20T203, 21T203, 20T403, 22A403
	Knob	PB40633	Tone - Models 24T202, 17A204, 18A204, 19A204, 20T204, 21T204, 20T404, 22A404
	Knob	AB43099-1	VHF channel selector - Model 20T210
	Knob	AB40636-1	VHF channel selector - Models 24T201, 17A203, 18A203, 19A203, 20T203, 21T203
	Knob	PB40636-2	VHF channel selector - Models 24T301, 20T403, 22A403
	Knob	PB40616-1	VHF channel selector - Models 17A204, 19A204, 21T204, 24T202, 18A204, 20T204
	Knob	PB40616-2	VHF channel selector - Models 20T404, 22A404
	Knob	PB40618	UHF channel selector - Models 24T202, 17A204, 18A204, 19A204, 20T204, 21T204, 20T404, 22A404
	Knob	PB40363-1	Fine tuning - Model 20T210
	Knob	PB40637	Fine tuning - Models 24T201, 24T301, 17A203, 18A203, 19A203, 20T203, 21T203, 20T403, 22A403
	Knob	PB40617	Fine tuning - Models 24T202, 17A204, 18A204, 19A204, 20T204, 21T204, 20T404, 22A404
	Safety Glass	PB40625-2	Models 20T210, 24T201, 24T202, 24T301
	Safety Glass	PB40625-1	Models 19A203, 19A204, 20T203, 20T204
	Safety Glass	PB40628-1	Models 17A203, 17A204, 18A203, 18A204, 21T203, 21T204, 20T403, 20T404, 22A403, 22A404
	Mask	PD94006	Models 20T210, 24T201, 24T202, 24T301
	Mask	PE97008-3	Models 19A203, 19A204, 20T203, 20T204, 20T403, 20T404
	Mask	PD97008-2	Models 17A203, 17A204, 21T203, 21T204, 22A403, 22A404
	Mask	PE97008-1	Models 18A203, 18A204

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TROUBLE SHOOTING AIDS (cont)

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V17, V18, V19 and V20. Check fuse, M1. Check waveform W17.

If Satisfactory	If Unsatisfactory
Check T3, T5A, T6, T7, C91, C90, C88, R104 and other associated components.	Check L22, C83, C84, C87, R97, R95, R96 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V18, V19, V21 and V22. Check C87, R104, and other associated components.

BLOOMING

Check by substitution V18, V19, V20, V21 and V22. Check C87, C92, R104, R107 and other associated components.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video".

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or no Sound".

RASTER, NO SOUND, NO PICTURE

Check by substitution V1, V2, V3, V4, V5 and V6. Check video IF components for failure or change of value.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set".

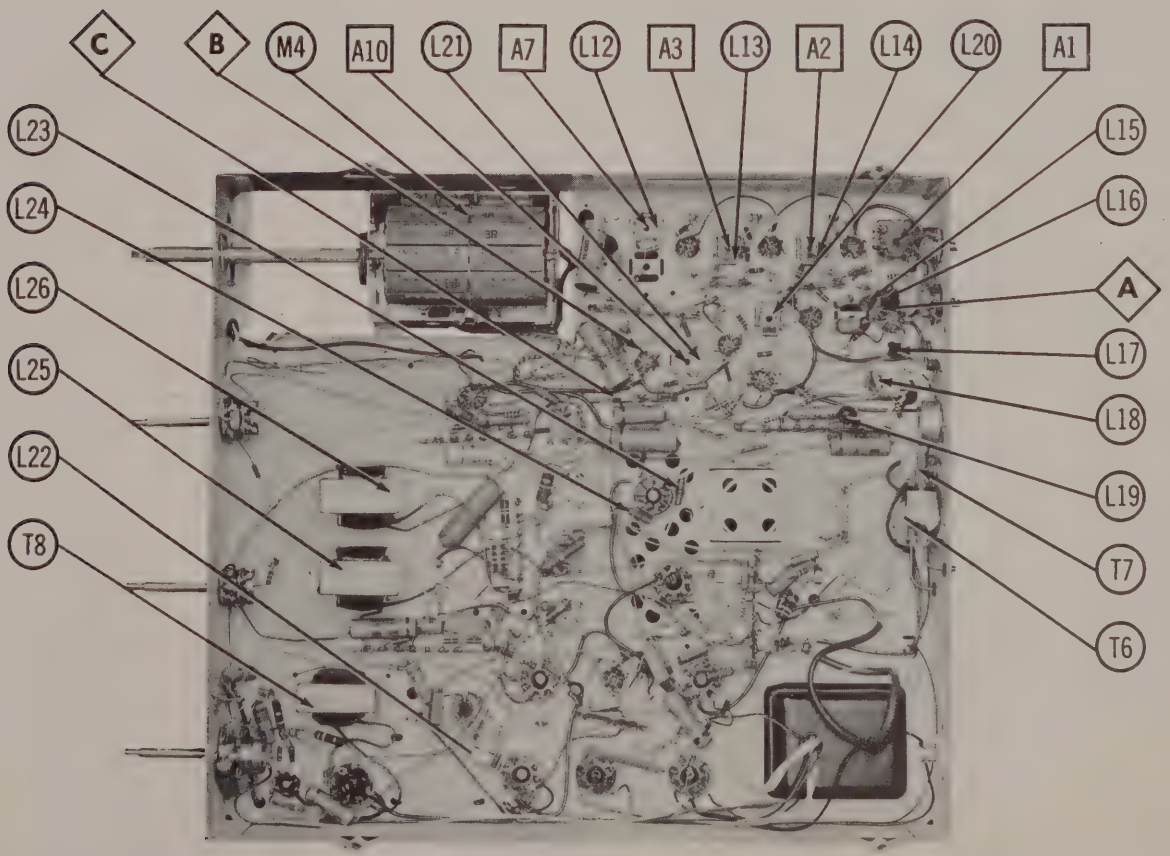
KEYSTONE EFFECT

Check T5 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



CHASSIS BOTTOM VIEW-TRANS., INDUCTOR & ALIGN. IDENTIFICATION

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

Touch-up adjustments of the VHF tuner oscillator circuit may be accomplished by removal of the channel selector and fine tuning knobs. The adjustments are accessible, one at a time, thru the small hole in the cabinet to the right of the channel selector shaft.

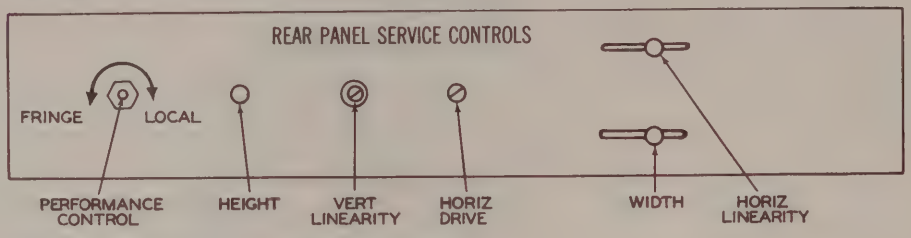
PICTURE TUBE SAFETY GLASS CLEANING

To clean safety glass remove 3 wood screws holding metal strip at the top of the safety glass. Remove metal strip and safety glass. Use extreme caution when removing safety glass.

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION



SPECIAL ADJUSTMENTS - AGC PERFORMANCE CONTROL

Set the AGC performance control (R4A) to its fully counter clockwise position. Tune in the strongest TV station available.

Turn the contrast control fully clockwise. If picture appears normal leave R4A in its fringe position (fully counter clockwise). If signs of overloading are noted turn R4A in a clockwise direction until a normal picture is obtained. Do not turn R4A further clockwise than necessary to obtain a normal picture.

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

For adjustment of the horizontal oscillator it is necessary to remove the rear cover and supply power to the set. Adjustment is located on top of chassis. Set the horizontal hold control to the center of its range and adjust the horizontal oscillator coil (L22) until picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the ratio detector secondary (L21) located on top of chassis. (See tube placement chart).

FUSES

One fuse is used for horizontal sweep circuit protection. (For location see tube placement chart).

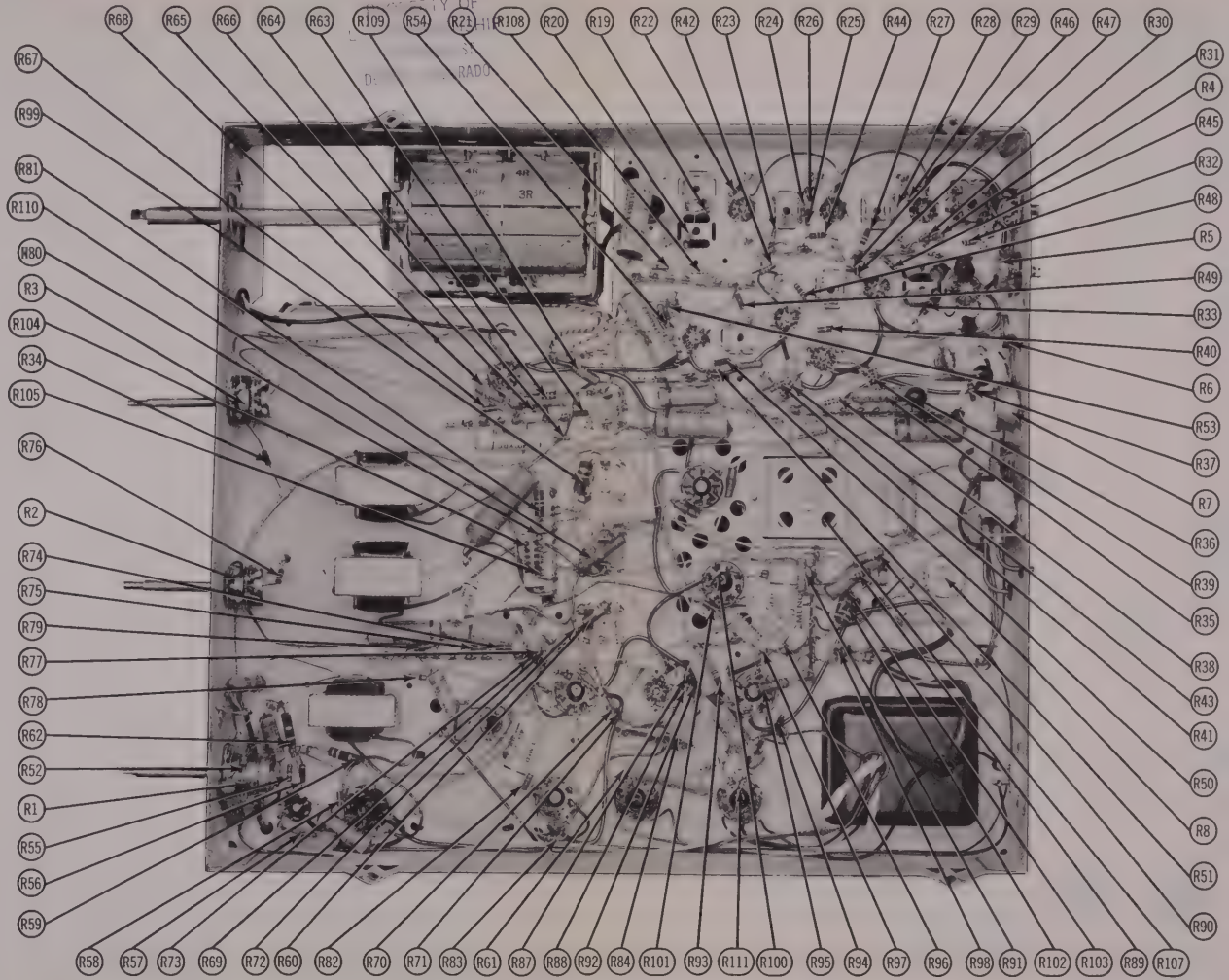
CENTERING

Centering is accomplished mechanically by means of a centering lever on the PM focusing assembly. Adjust the centering lever from side to side, and up and down until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

CHASSIS REMOVAL

1. Remove 8 push-on type control knobs from front panel of cabinet.
2. Remove 7 wood screws and 1 metal screw. Remove rear cover.
3. Remove 2 wood screws. Remove antenna bracket.
4. Disconnect speaker leads. Remove 2 speaker nuts. Remove speaker.
5. Remove 4 chassis bolts. Remove chassis.



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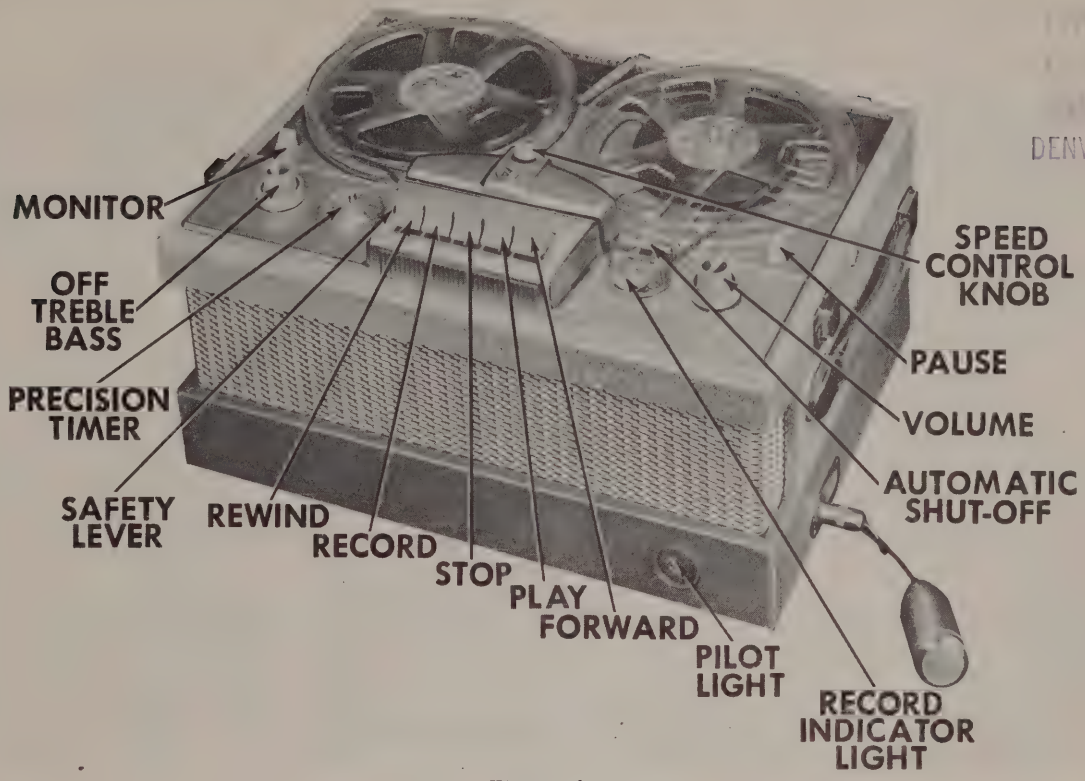

Figure 1

GENERAL INFORMATION

The V-M Tape-o-matic 700 features fingertip operation for Fast Forward, Playback, Stop, Record, and Rewind. The Tape-o-matic is designed to record and play back two tracks of material on standard width recording tape (1/4"), which doubles the playing time of a standard 5" or 7" reel of tape with no loss of frequency response or quality. Recordings can be made from a radio, television receiver or phonograph (using a crystal or magnetic cartridge), in addition to those made directly from the microphone. Recordings can be played back through the self-contained speakers or external speakers through use of the Auxiliary Speaker Jacks.

The Tape-o-matic has two tape speeds, 7 1/2" and 3 3/4" per second. Using both tracks, the recording time is as follows:

SIZE REEL	SPEED 3 3/4"	SPEED 7 1/2"
5"	1 hour	1/2 hour
7"	2 hours	1 hour

The Model 700 is designed to operate on 60 cycle, 110-120 volts, AC supply only. Power consumption: 100 Watts.

CAUTION: **Severe Damage** Will Result If Connection Is Made To A Direct Current (DC) Line.

Manufactured by:

V-M Corporation
Benton Harbor, Michigan

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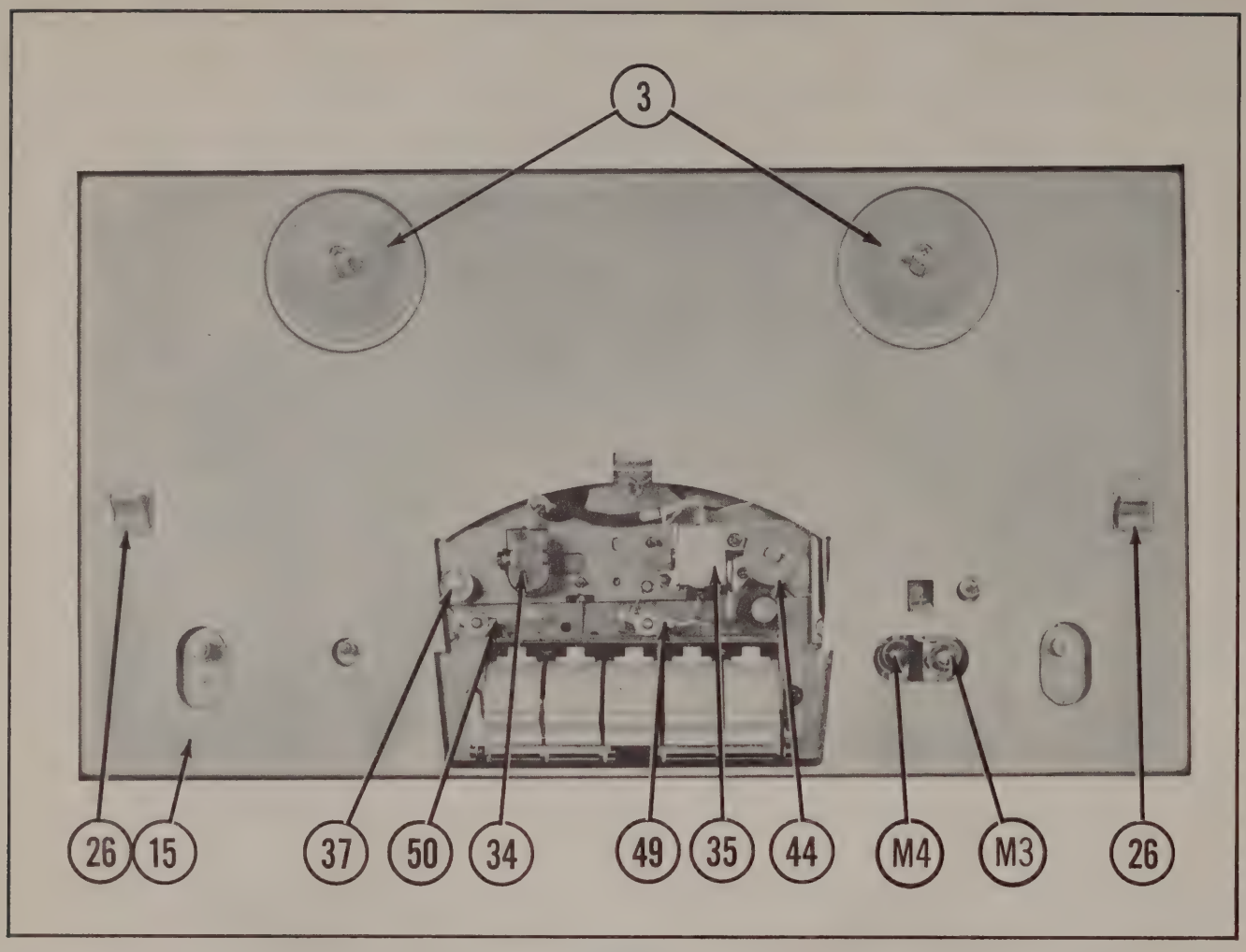

Figure 2

SPECIFICATIONS

Weight-
30 Lbs. approximately.

Size-
9 1/8 x 11 3/8 x 15 5/8 inches.

Power Cord-
8 feet long.

Microphone-
Extended fidelity 60 to 10,000 cycles ± 5db and 8 foot shielded cable with phono plug.

Amp. Tube Complement-
(1) 5879, (1) 12AX7, (2) 6V6, (1) 5Y3.

Dual Bass & Treble Boost-
+10db at 50 cycles and +6db at 8000 cycles.

Record Bias & Power Erase-
60 to 70 KC.

Wow & Flutter-
Less than .4% RMS.

Controls-

5 Safety Interlocked buttons for - Stop (and storage), Record, Play, Fast Forward and Fast Rewind.

Concentric Bass and Treble Controls.

Volume Control.

Instant Pause Control with stand-by lock.

Monitor Switch

Precision Tape Index Counter.

Automatic Shut-Off.

Bias Current (concealed).

Record Overload Indicator with sensitivity adj..

Speakers-

(1) 5 x 7 woofer with 3.5 oz. Alnico V magnet.

(1) 3 1/2" tweeter with 1.5 oz. Alnico V magnet.

(1) L-C crossover network.

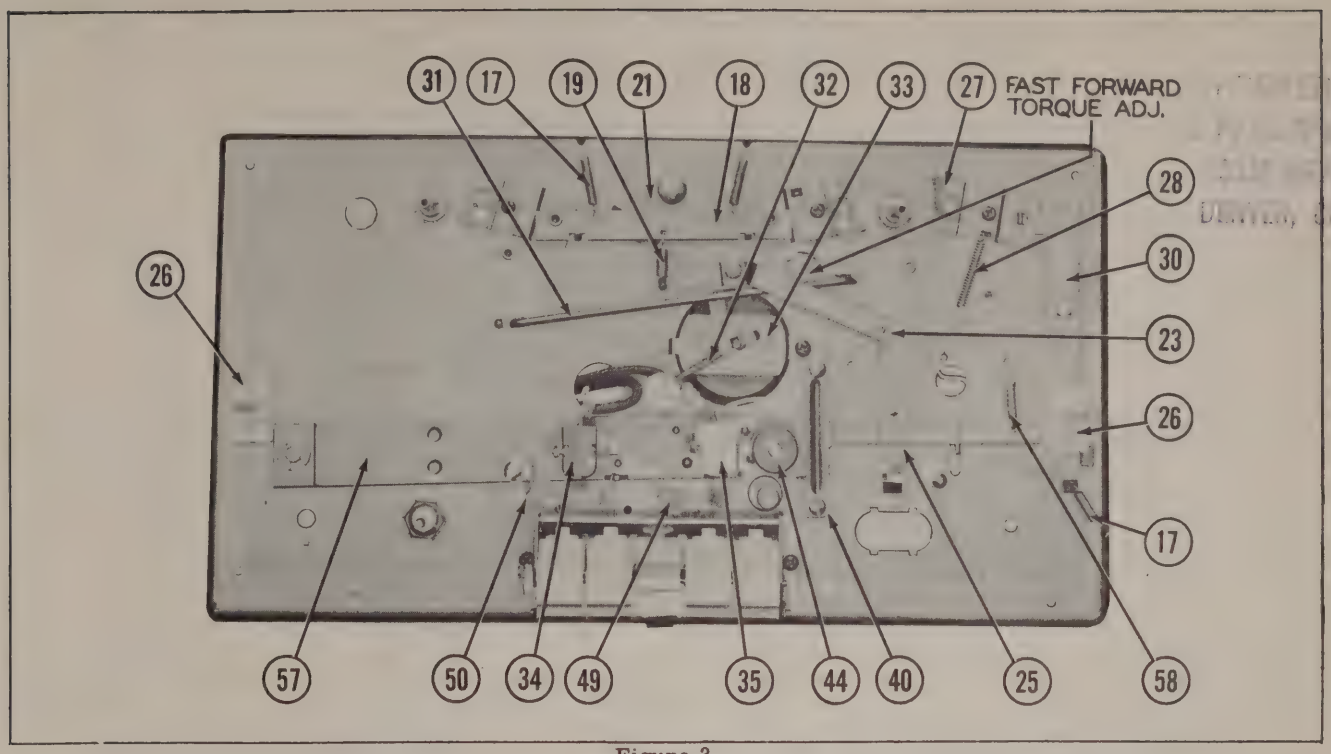

Figure 3

Signal To Noise Ratio-
Lower than - 45db.

Audio Range-
60 to 12,000 cycles.

2 Input Jacks-
Microphone-Radio-Phono-TV, Magnetic Phono.

Output Jacks-
(1) Direct connected jack for extra speaker or meter.

(1) Switching speaker jack for use without internal speaker operation, and controlled by monitor switch.

2 Reels-
7 inch reels furnished - one with 1250 feet of tape and one empty.

OPERATING INSTRUCTIONS

Threading The Tape-

With the "Stop" button depressed, place an empty reel on the right hand (take-up) spindle. Place a full reel of tape on the left hand (supply) spindle so that it unwinds counterclockwise. Remove approximately twenty inches of tape from the supply reel for ease of threading the machine. Thread tape, following threading line straight through or between the two plastic covers, move the small plastic automatic "Shut-off" lever back and guide the tape in front of it, as shown in Fig. 1. After the tape has passed the automatic "Shut-off" lever place it in front of the chrome plated tape guide and onto the empty right hand reel. Insert the free end of the tape into the hub slot of the take-up reel, then wind the reel one or two times counterclockwise to take up all the slack.

NOTE: Extreme caution should be taken in the threading of the machine to avoid putting a twist in the tape. Also make certain the smooth (or plastic) side of the tape is facing the front of the machine.

To Record-

1. Secure the line cord in the slot provided at the back of the case and plug the line cord into 110 volt, 60 cycle AC outlet and connect microphone or any other type of input.

2. Switch the machine on by turning the "Treble" control clockwise.

3. Push the "Pause" button backward and lock to the right.

4. Push the red "Safety" button (marked S) to the right and depress the "Record" button. Adjust the volume control so that faint flashes register on the "Distort" light at loudest sounds (peak output). At the same time make certain the counter is set at zero.

5. Release the "Pause" button to begin recording. (Also use the "Pause" button for noiseless momentary stops, to eliminate commercials, lulls in conversation, etc.)

NOTE: Always depress "Stop" button when you have finished using the recorder.

To Play Recordings-

1. Secure the line cord in the slot provided at the back of the case and plug the line cord into a 110 volt, 60 cycle AC outlet and turn the machine on by turning the "Treble" control clockwise.

2. With the "Stop" button depressed thread the tape as outlined under the heading "Threading The Tape".

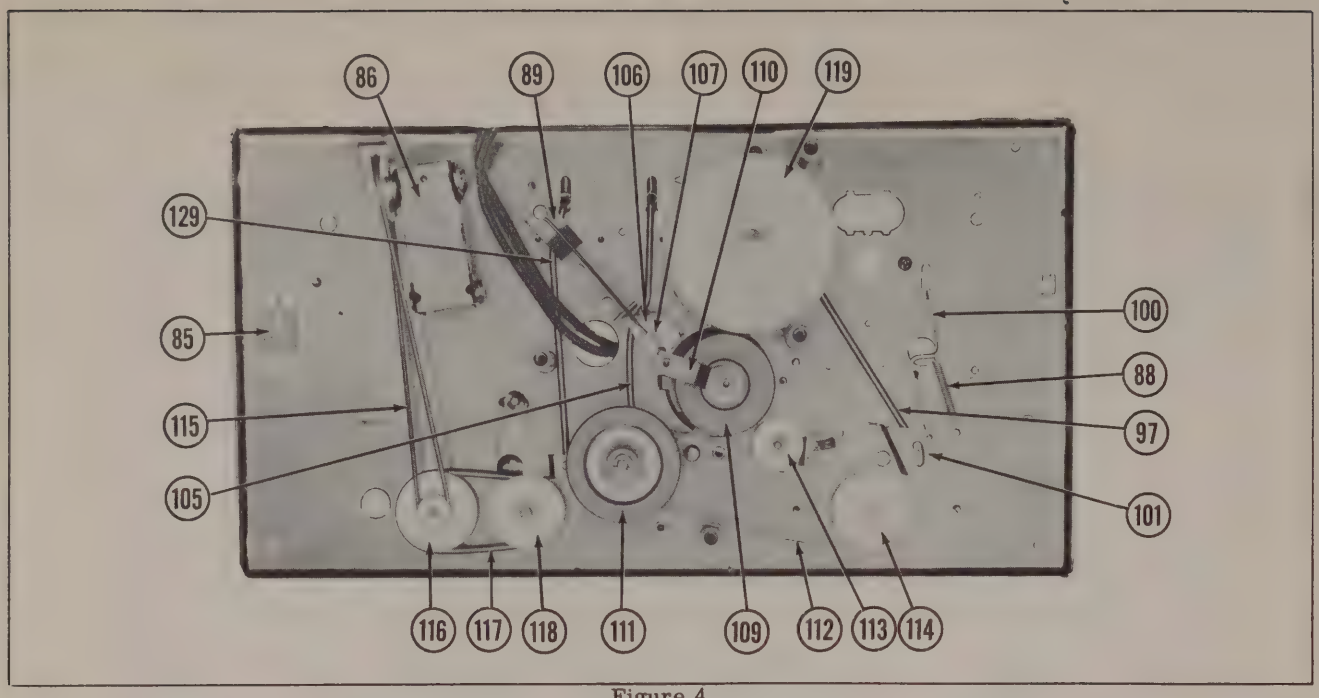

Figure 4

3. Depress the "Play" button and adjust the volume and tone controls for most pleasing reproduction.

4. Depress the "Stop" button when finished.

Dual Track Recording-

The Tape-o-matic is designed so that only 1/2 the tape width is recorded at a time; thereby resulting in two track recording. This two track operation is accomplished in the following manner:

1. After a reel of tape has been recorded; i.e. all the tape wound onto the right reel, depress the "Stop" button.

2. Remove the reels from the recorder, turning the full reel over and placing it on the left spindle.

3. Properly thread the tape and proceed with the recording.

4. After the second track has been recorded the first track of recording is ready to be played, without rewinding, by reversing the reels as described in Step #2 above.

To Edit And Splice Tape-

NOTE: Since it is impossible to edit and splice one track without affecting the other, recordings which are to be edited should be limited to one track only.

1. The tape may be edited by cutting out unwanted portions, or by joining selections into another sequence. Announcements may be inserted between selections, etc. Unused sections of tape can be spliced together for re-use.

2. For best results, cut tape at a slight diagonal, join ends together with splicing tape on the glossy side and trim off any excessive width.

FUNCTIONS OF THE PUSH BUTTONS

Stop Button-

The "Stop" button should be depressed before each operation and when the machine is not in use.

Record Button-

To depress the "Record" button the red "Safety" lever must first be held to the right.

Play Button-

Depress the "Play" button for playing back a recording. Adjust the volume control to the desired level and adjust the tone controls for the most pleasing reproduction.

Rewind Button-

Depress the "Rewind" button for high speed rewind of the tape.

Forward Button-

Depress the "Forward" button for high speed forward. This button is used when a certain selection is to be listened to on a reel of pre-recorded tape.

Indicator Lights-

Distorted:
Indicates that the tape is being overloaded (surplus volume) when recording. Adjust the volume control so that faint flashes occur at loud sounds (peak output).

Ready:
Indicates that machine is ready for recording and lights only when the "Record" button is depressed.

TROUBLE CHART Con't.

SYMPTOM	CAUSE	REMEDY
	6. Eccentric Flywheel.	6. Replace.
	7. Button lever (71) not adjusted properly.	7. (See "Take-up reel revolves fast in Play or Record position").
	8. Bumpy or eccentric capstan idler (109).	8. Replace.
	9. Head bar bracket loose.	9. (See "Take-up reel revolves fast in Play or Record position").
	10. Pressure roller (44) not aligned properly.	10. See (Adjustments).
Unit does not turn on with Off-On Switch	1. No current at motor or amplifier.	1. (A) Check that current is reaching AC leads. (B) Check that fuse (M6) is not burned out. If so, replace. (C) Check that Off-On switch and automatic shut-off switch are closing.
Button Interlock (70) inoperative.	1. Interlock bar return spring loose or broken.	1. Replace.

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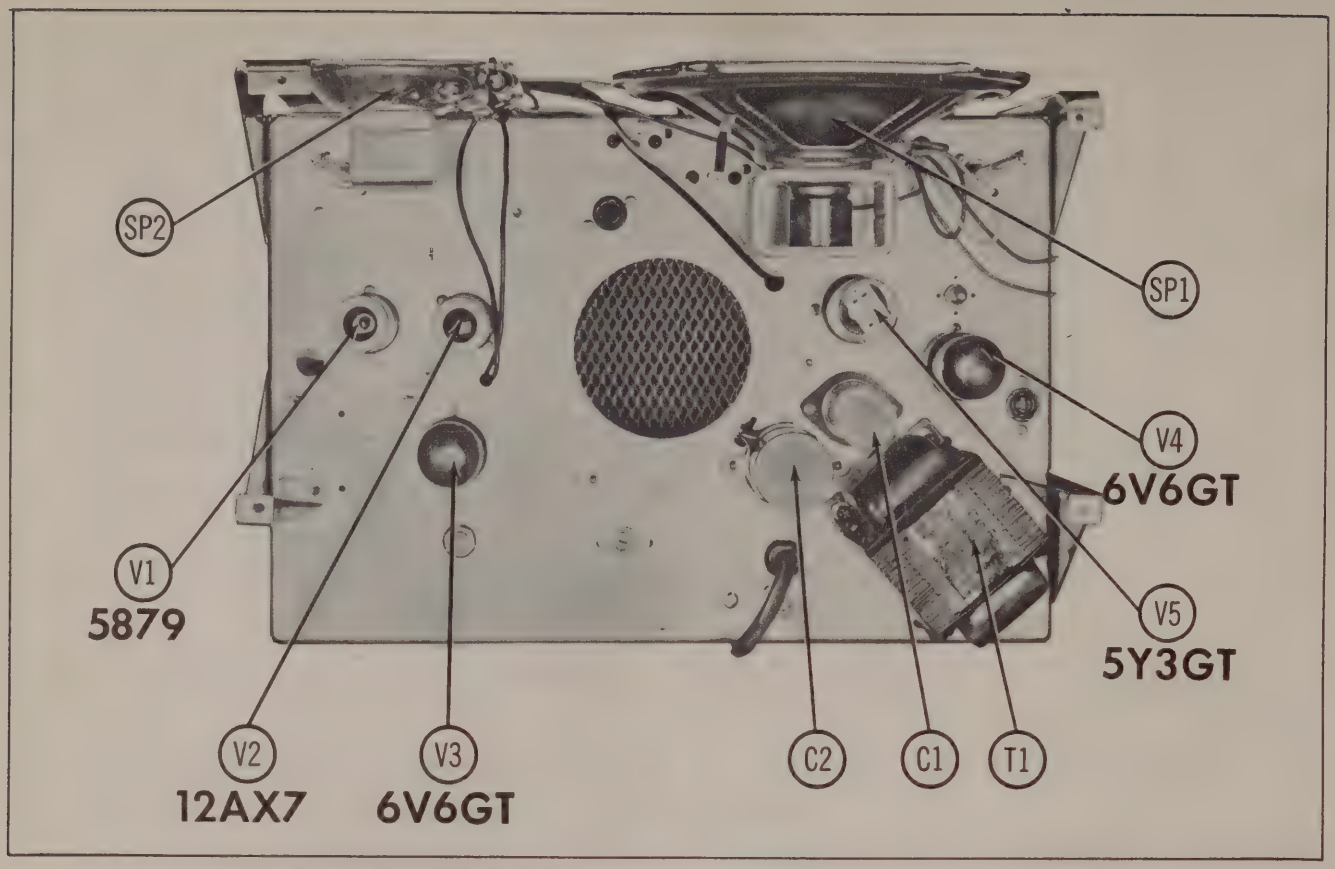
ELECTRICAL PARTS LIST

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
V1	8216	5879, Pre-Amp.	R14	10853-5	Resistor, 3.3KΩ, 1/2 Watt±5%
V2	5222	12AX7, Pre-Amp., AF Amp.	R15	11293	Resistor, 220KΩ, 1/2 Watt
V3	5223	6V6-GT, Audio Output	R16	10813-5	Resistor, 2.2KΩ, 1/2 Watt±5%
V4	5223	6V6-GT, Bias Oscillator	R17	11213	Resistor, 100KΩ, 1/2 Watt
V5	5224	5Y3-GT, Rectifier	R18	10893-5	Resistor, 4.7KΩ, 1/2 Watt±5%
C1	12044	Elect. Cap., 40mfd. @450V.	R19	10853-5	Resistor, 3.3KΩ, 1/2 Watt
C2A	12045	Elect. Cap., 30mfd. @450V.	R20	10853-5	Resistor, 3.3KΩ, 1/2 Watt±5%
C2B		Elect. Cap., 40mfd. @450V.	R21	11453	Resistor, 1Meg., 1/2 Watt
C2C		Elect. Cap., 10mfd. @450V.	R22	11948	Resistor, 300Ω, 5 Watt
C2D		Elect. Cap., 10mfd. @450V.	R23	11293	Resistor, 220KΩ, 1/2 Watt
C3	12046	Elect. Cap., 10mfd. @25V.	R24	11213	Resistor, 100KΩ, 1/2 Watt
C4	12035	Cap., Molded Paper, .01mfd. @400V.	R25	11333	Resistor, 330KΩ, 1/2 Watt
C5	12032	Cap., Molded Paper, .0033mfd. @400V.	R26	11453	Resistor, 1Meg., 1/2 Watt
C6	12048	Cap., Ceramic Tub., 100mmf. @600V.	R27	11213	Resistor, 100KΩ, 1/2 Watt
C7	12034	Cap., Molded Paper, .1mfd. @400V.	R28	10733	Resistor, 1000Ω, 1/2 Watt
C8	12036	Cap., Molded Paper, .22mfd. @400V.	R29	11133	Resistor, 47KΩ, 1/2 Watt
C9	12033	Cap., Molded Paper, .047mfd. @400V.	R30	11133	Resistor, 47KΩ, 1/2 Watt
C10	12035	Cap., Molded Paper, .01mfd. @400V.	R31	11948	Resistor, 300Ω, 5 Watt
C11	12033	Cap., Molded Paper, .047mfd. @400V.	R32	11213	Resistor, 100KΩ, 1/2 Watt
C12	12042	Cap., Ceramic Tub, 20mmf. @600V.	R33	11134	Resistor, 47KΩ, 1 Watt
C14		Cap., Molded Paper, .02mfd. @400V.	R34A	11970	Resistor, 500Ω, 5 Watt
C15	12034	Cap., Molded Paper, .1mfd. @400V.	R34B		Resistor, 500Ω, 5 Watt
C16	12038	Cap., Molded Paper, .47mfd. @200V.	R35	10194-10	Resistor, 5.6Ω, 1 Watt
C17	12034	Cap., Molded Paper, .1mfd. @400V.	R36	10135	Resistor, 3.3Ω, 2 Watt
C18	12048	Cap., Ceramic Tub., 100mmf. @600V.	R37	10773	Resistor, 1.5KΩ, 1/2 Watt
C19	12035	Cap., Molded Paper, .01mfd. @400V.	T1	12509	Power Transformer
C20	12040	Cap., Ceramic Tub., 1000mmf. ±10% @600V.	T2	12510	Output Transformer
			L1	12511	Bias Osc. Coil
C21	12058	Cap., Mica, 3500mmf.	L2	12514	Speaker Inductance Coil
C22	12039	Cap., Ceramic Tub. 680mmf. @600V.	SP1	8229	Speaker, 5x7"; 3 oz. Alnico 5; 3.2Ω
C24	12047	Cap., Ceramic Tub., 33mmf. @600V.	SP2	8230	Speaker, 3 1/2"sq.; 1.5 oz. Alnico 5; 3.2Ω
R1	11984	Volume Control, 2 Meg. ±30%			
R2A	11973	Bass Control, 5000Ω	M1	8221	Jack-Switchcraft #12-A
R2B		Treble Control, 5000Ω	M2	5216	Jack-Switchcraft #11
R3	11981	Bass Limit Control, 10KΩ±30%	M3	8218	Distort Indicator, Neon-NE-51
R4	11978	Neon Sensitivity Control, 2 Meg. ±30%	M4	8218	Ready Indicator, Neon-NE-51
R5	11974	Hum Control, 150Ω, W.W.	M5	4654	Pilot Light, Type #TS-47
R6	11093	Resistor, 33KΩ, 1/2 Watt	M6	8232	Fuse-3 Amp., Type 3AG
R7	11693	Resistor, 10Meg., 1/2 Watt	M7	8120	Playback Switch Assembly
R8	10494-5	Resistor, 100Ω, 1Watt± 5%	M8	8119	Record Switch Assembly
R9	11453	Resistor, 1Meg., 1/2 Watt	M9	8206	Head Plug-4 Prong
R10	11054	Resistor, 22KΩ, 1 Watt	M10	8202	Socket-4 Prong
R11	11294	Resistor, 220KΩ, 1 Watt	M11	5577	Socket-3 Prong
R12	11133	Resistor, 47KΩ, 1/2Watt	M12	5578	Plug-3 Prong
R13	11453	Resistor, 1 Meg., 1/2 Watt			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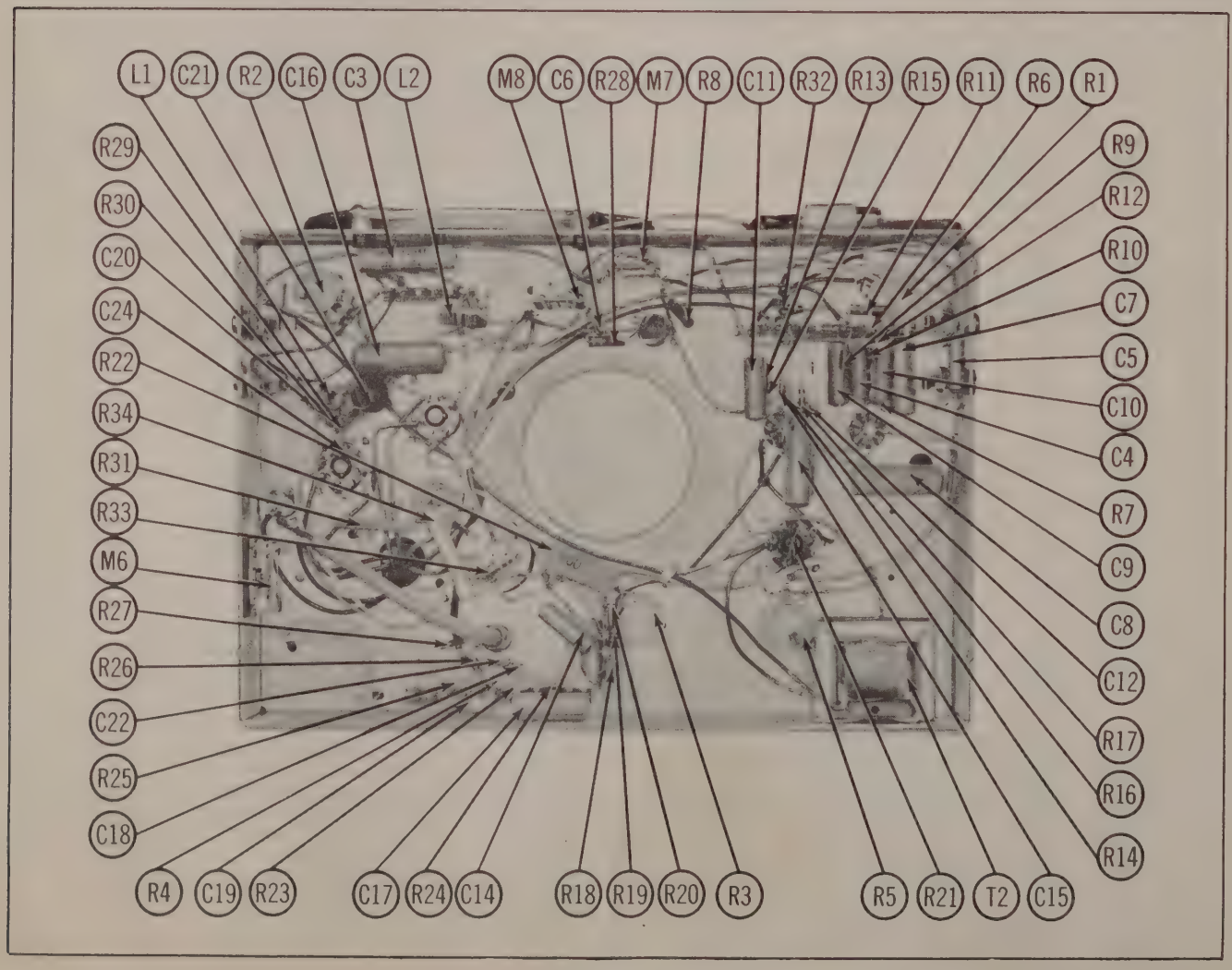
C2
C1
T1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R1
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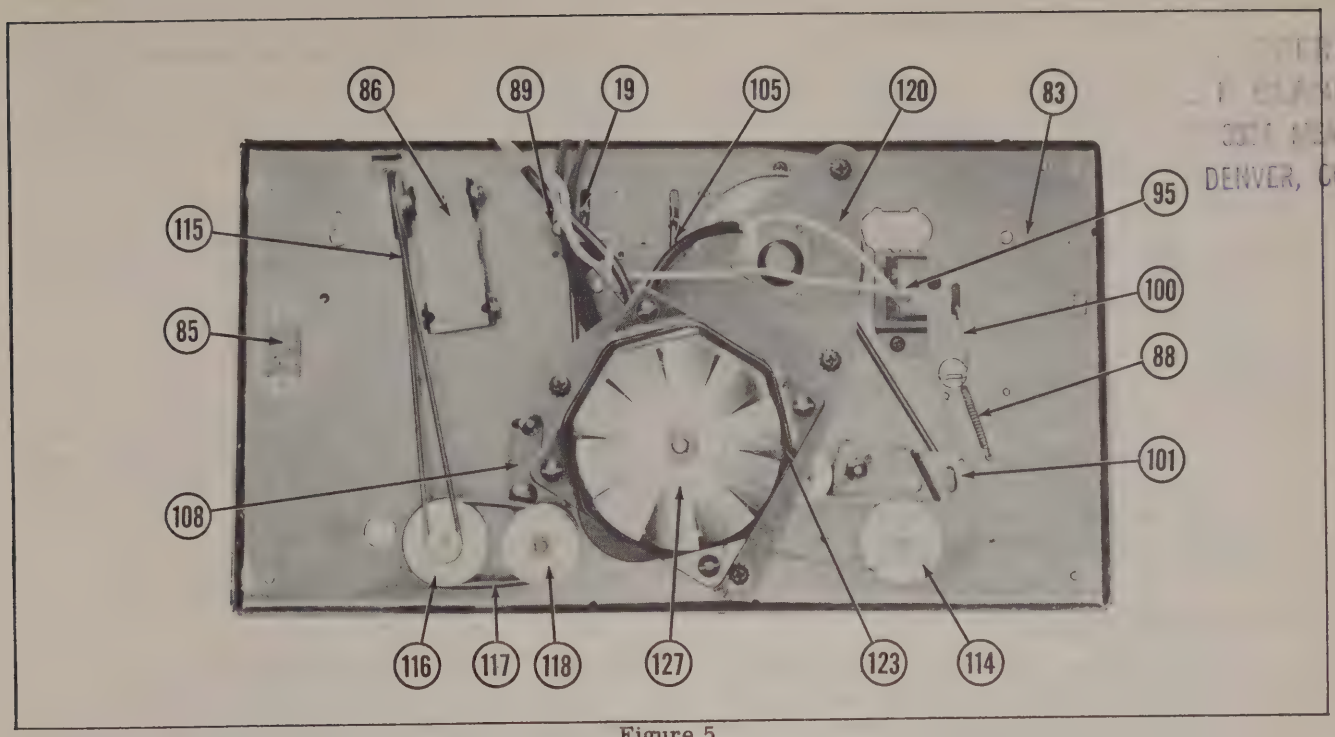

Figure 5

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Speed Control Button-

The arrow on the speed control button points to the speed (inches per second) at which the tape is passing by the record or playback head. Should a change in speed be desired, simply turn the speed control button with a coin. Insofar as quality of recording-reproduction is concerned, we find that speed is an all-important factor. The higher the speed, generally, the greater will be the fidelity.

Safety Lever (Red)-

This lever locks the "Record" button preventing accidental erasure. To release, push to right and hold and depress "Record" button.

Precision Timer-

Set both the large and small dials of the precision timer to zero after threading a reel of tape. This timer should be used for the ease of locating a pre-recorded selection on the tape. The carton in which your tape came in has provisions for which you can write in the various "timer" readings.

Pause Button-

To stop the travel of the tape while recording or playing push the "Pause" button. Should you desire to lock the "Pause" button in position, simply push backward on the "Pause" button and to the right. The "Pause" button feature allows for the adjustment of recording volume before any tape is used and also for noiseless momentary stops, to eliminate commercials from the radio or television set, plus lulls in conversation, etc.

Monitor-

The "Monitor" switch is used should you desire to listen to a recording while it is being made. Also, the "Monitor" switch should be left in the "On" position should the unit be used as a phonograph amplifier or a public address system.

Automatic Shut-off-

The mechanism is automatically shut off unless the tape is threaded in front of the plastic shut-off lever. When a reel of tape becomes empty or should the tape break, the mechanism will shut off automatically and will remain so until the machine is rethreaded.

Inputs-

Microphone Jack:
Any high impedance crystal or dynamic microphone may be plugged into this jack for recording, or public address use.

Radio Phono Jack:
Use the special adaptor supplied with your recorder, and insert a standard phono plug into the adaptor to record or play from phonograph.

Magnetic Phono Jack:
This high gain input has special equalization for a magnetic phono cartridge, such as the "GE" or "Pickering", and is automatically disconnected when using the Microphone-Radio-Phono jack.

Speakers-

Jack #1:
Internal speakers are automatically disconnected when an external speaker is plugged into this jack.

Jack #2:
Internal speakers operate normally when an external speaker is plugged into this jack. (This jack may also be used with an external meter for precision monitoring of record volume.) Two external speakers may be used simultaneously by using both speaker jacks.

MECHANICAL ADJUSTMENTS

Tape Guide Adjustment-

The tape should pass through tape guides (37, 46) and the stationary guide evenly. The bottom of tape guide (37) must be set approximately 9/16" from the top of baseplate (83).

Play-Record And Erase Head Alignment-

With tape guides set properly, the top of the record head pole pieces must be set even with the top edge of the tape. The top of the erase head pole pieces should be approximately .005" above the top edge of the tape.

For Azimuth alignment of the play-record head a 1 mil alignment tape must be used. Thread tape on unit (see "Threading The Tape") and push "Play" button. Adjust head for maximum output by turning mounting nuts on head nest (39).

Head Bar Bracket Adjustment-

Adjust head bar bracket (40) so that head bar (57) moves free without binding. If bracket is too loose, pressure roller (44) will not press against capstan evenly causing flutter or the tape to climb.

Pressure Roller Alignment-

The pressure roller stud must be parallel with the capstan or tape will creep up or down on the capstan. As a check, remove "C" washer (42) and raise pressure roller (44) slightly and depress the "Play" button. If pressure roller raises or lowers, straighten stud by using tool #2-C-109 or by slipping a close fitting sleeve over the stud.

Pressure Roller Pressure Adjustment-

The pressure roller pressure should be from 2 1/2 to 3 1/2 pounds against the capstan in "Record" and "Play" position. To adjust pressure, bend button levers (71) where head bar activating springs (62) are hooked. To decrease pressure, bend tab in; to increase, bend tab out.

Stop Adjustment-

Bend stop button lever (71) where brake activating hook (80) connects so brakes release reel discs completely when another button is depressed. When stop button is depressed, bell crank (104) must disengage capstan idler (109) from motor shaft and flywheel and capstan assembly (119).

Play & Record Torque Adjustment-

The takeup torque in "Play" and "Record" should be 1 1/2 to 3 ounces measured 2 3/4 inches from the center of the take-up reel. Using a pair of needle nosed pliers or a special tool, bend take-up actuator (100) at point "A" on exploded view, shortening or lengthening to increase or decrease torque.

Fast Forward Torque Adjustment-

The fast forward torque must be 5 to 7 ounces measured 2 3/4 inches from the center of the take-up reel. To adjust, insert a 3/8" spintite through the hole provided in the baseplate (see Figure 3). Turn the eccentric mounted tension pulley (113) counterclockwise to increase torque and clockwise to decrease torque, making sure not to exceed maximum travel of the eccentric.

Rewind Torque Adjustment-

The rewind torque should be 2 1/2 to 4 1/2 ounces measured 2 3/4 inches from the center of the rewind reel. If torque is low, make sure rewind driver (118) is not skidding on take-up driver (111). Clean rewind belt (117) of any oil or grease.

Pause Brake Adjustment-

With tape on machine and "Play" button depressed, bend tab (point "B" on exploded view) on pause brake lever (30) so right reel stops and tape drive is released simultaneously.

ELECTRICAL ADJUSTMENTS

Bass Boost Limit Control Adjustment-

With unit in "Stop" position and "Bass" control fully counterclockwise, apply a 100 cycle signal into the "Microphone" jack. Attach A-C voltmeter to speaker "Two" jack and insert 8 ohm load into speaker "One" jack. Adjust voltmeter and "Volume" control for a -20db reading. Adjust meter to 0db scale and turn "Bass" control fully clockwise. Adjust "Bass Boost Limit Control" for a -2db reading. Effective boost by "Bass" control is now 18db.

Distort Calibration Adjustment-

With unit in "Record" position, apply 1000 cycle signal to "Microphone" jack and attach A-C voltmeter to speaker "Two" jack. With "Monitor" switch "On", adjust "Distort Calibration" control so the "Distort" light flickers at .3 volt.

Hum Balance Adjustment-

With unit in "Play" position, turn "Volume" control up and adjust "Hum Balance" for minimum hum.

LUBRICATION

Lubricants applied at time of manufacture are sufficient to last for a long period of time, but in case parts are replaced or approximately once a year, lubricate as follows:

Apply S. A. E. #5 Motor Oil to:

1. Both capstan bearings. To oil capstan bearings, place one small drop of oil on each bearing. CAUTION: Be sure no oil is on the portion of capstan extending above baseplate.
2. Tension pulley (113) bearings.
3. Reel disc bearings (87).
4. Rewind driver (118) bearing.
5. Capstan idler (109) bearing.

6. Take-up driver (111) bearing.

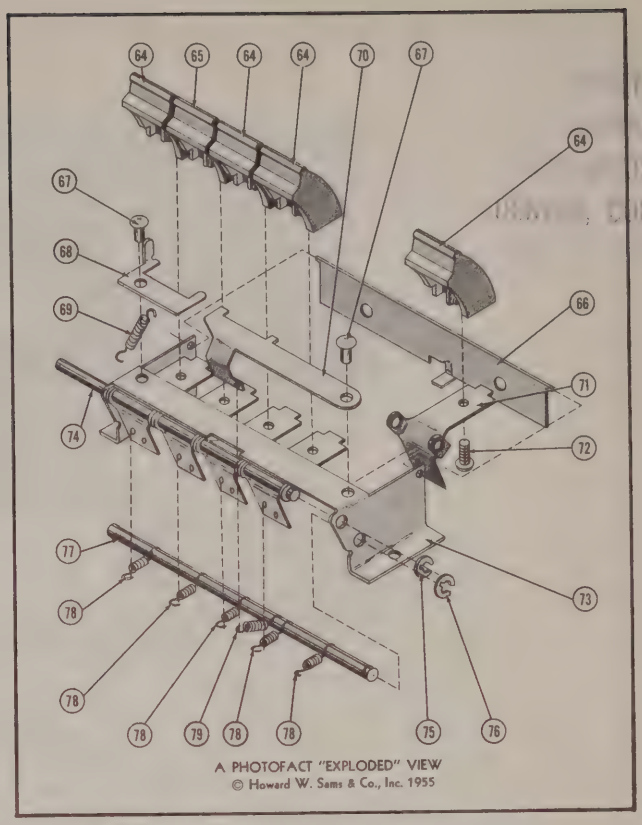
7. Pressure roller (44) bearing.

NOTE: When oiling any bearing in which a rubber part is mounted, or part using a belt, apply only one small drop of oil.

NOTE: Oil and grease must be kept off all rubber idlers, belts and periphery of flywheel and off parts that might transfer oil or grease to them.

Apply Trojan "H2" Grease to:

1. Between brake arm (18) and brake shoes.
2. Between brake shoes and baseplate.
3. Between rewind arm (108) and baseplate.
4. Under head bar (57) pivot bosses.
5. Top of head bar (57) above R. H. bosses.
6. Between take-up bar (101) and baseplate.
7. Between pause brake lever (30) and baseplate.
8. Between bell crank (104) and baseplate.
9. Latch bar (66) on cam side where button levers (71) make contact.
10. Latch bar (66) and button housing (73) pivot holes.
11. Brake rod (105) ends at baseplate holes.
12. Rewind rod (129) at baseplate hole.
13. Fast forward rod (97) at take-up bar (101) slot.



(63) CONTROL BUTTON ASSEMBLY

14. Take-up rod (31) at baseplate holes.

15. Holes in baseplate where amplifier switch extensions slide.

TROUBLE CHART

SYMPTOM	CAUSE	REMEDY
Record Button can be depressed without safety lever.	1. Record interlock return spring off or broken.	1. Replace.
	2. Tabs on record button interlock lever bent or broken.	2. Straighten or replace.
	3. Button sheered.	3. Replace.
Buttons do not stay depressed.	1. Latch bar spring off or broken.	1. Replace.
	2. Latch bar sticking or bent.	2. Repair or replace.
Counter inoperative.	1. Counter belt (115) off pulleys.	1. Replace.
	2. Counter dial loose.	2. Repair or replace.
	3. Gears Binding.	3. Counter must turn freely without binding. Check gears and pulleys for binding in time mechanism.
Pause Brake does not operate properly.	1. Tab on pause brake not adjusted properly.	1. (See "Take-up Reel revolves fast when Play or Record buttons are depressed").

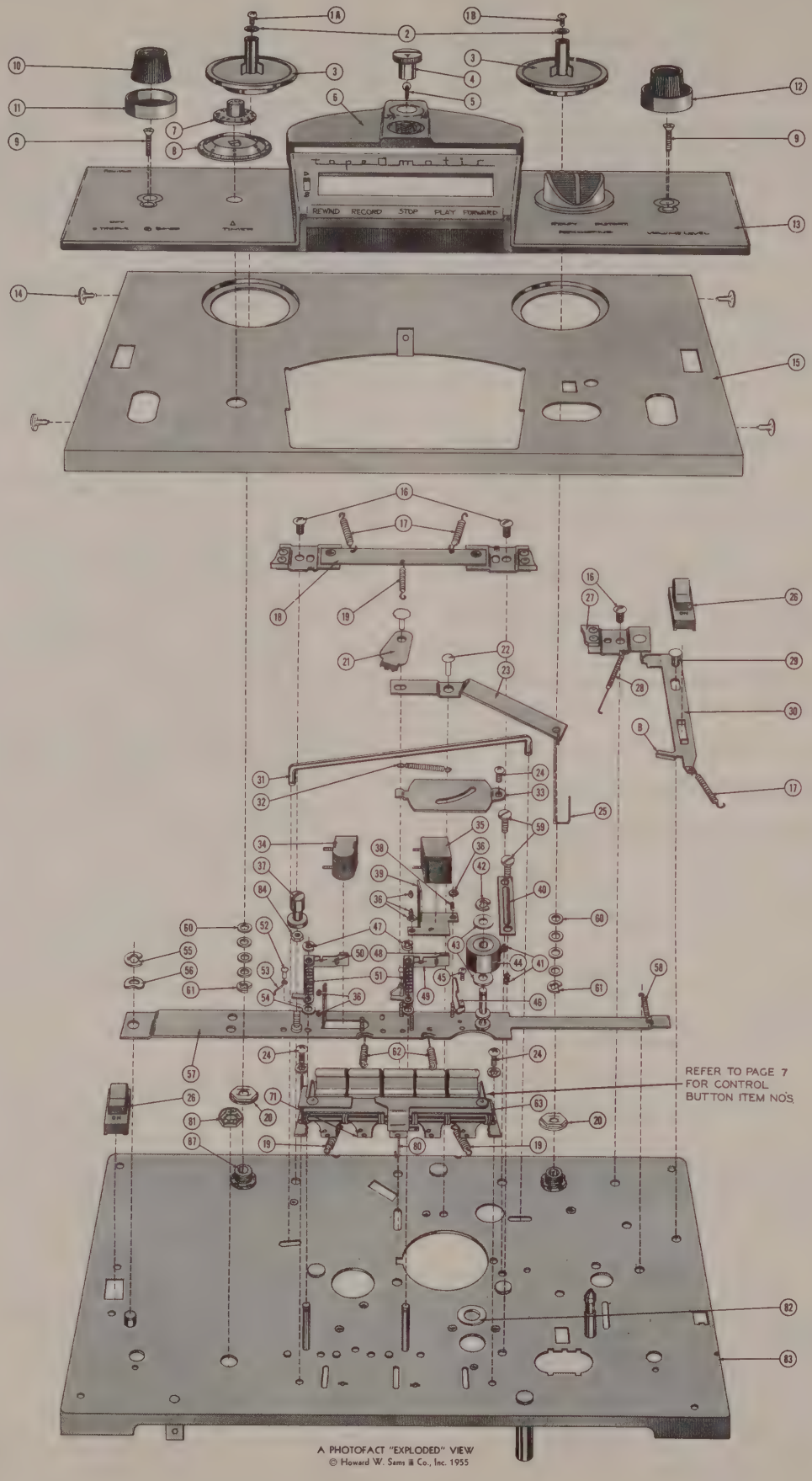

REWIND RECORD STOP PLAY FORWARD
REFER TO PAGE 7 FOR CONTROL BUTTON ITEM NOS.
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Figure 6A. Exploded View Of Parts Above Baseplate.

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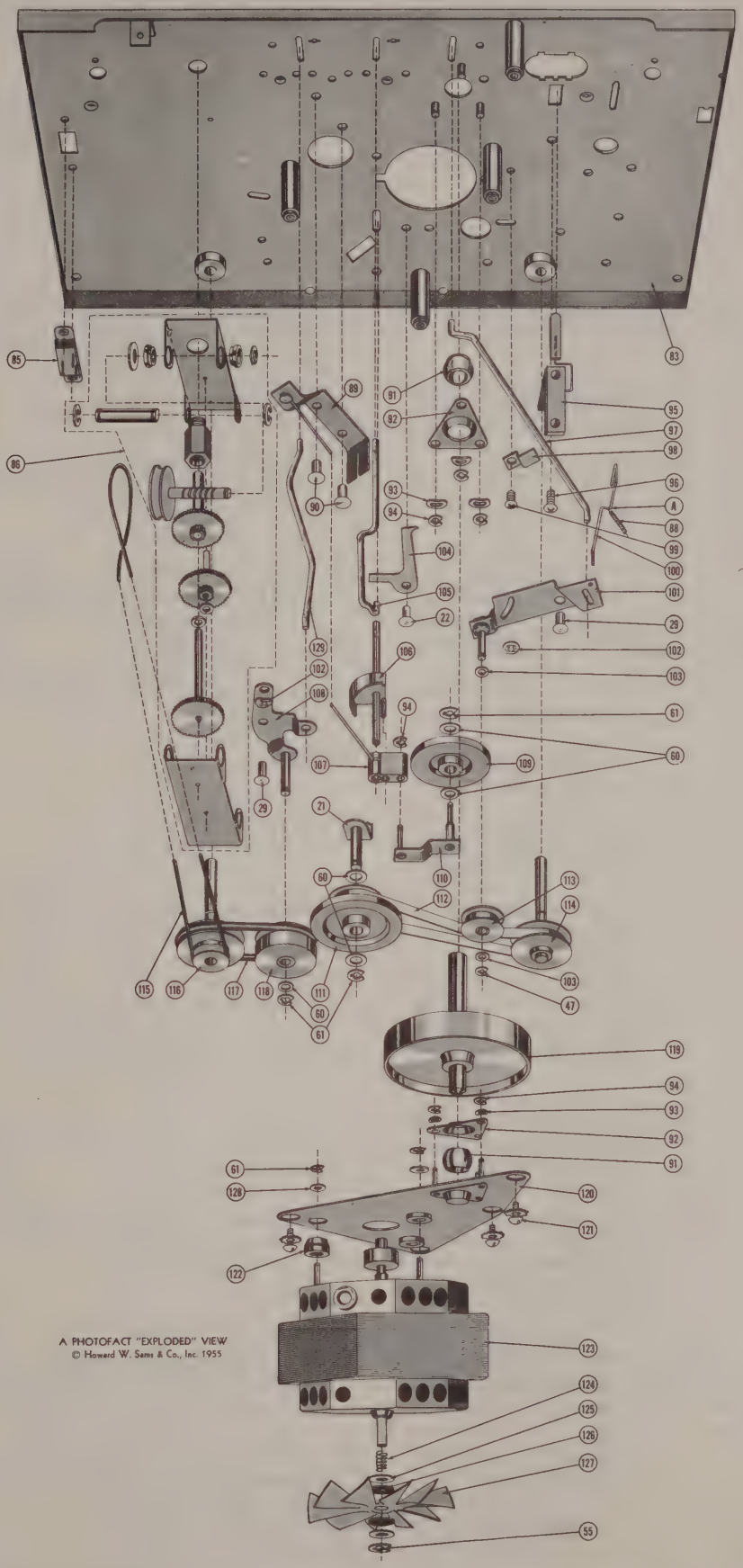

Figure 6B. Exploded View Of Parts Below Baseplate.

SYMPTOM	CAUSE	REMEDY
Take-up Reel does not revolve in play or record position.	1. Pause Brake on or sticking.	1. Release pause brake-check that pause brake lever (30) is free and releases completely.
	2. Brakes (18) not releasing properly.	2. Check that brakes (18) are releasing completely, if not, adjust button lever (71) on stop button.
	3. Take-up belt (112) worn.	3. Replace worn or stretched belt.
	4. Take-up belt (112) off pulleys.	4. Pulleys must be aligned correctly or belt will continue to slip off.
	5. Capstan idler (109) not engaging flywheel.	5. Check that speed change button is in detent completely, also check that bell crank (104) is releasing the capstan idler (109).
	6. Speed change not in detent completely.	6. Turn button to proper speed.
	7. Tension pulley (113) not engaging take-up belt.	7. Check that take up arm (101) is not binding on baseplate or take up rod (97).
	8. Pressure roller (44) applying too much pressure against capstan, stalling motor.	8. Adjust button lever (71) on play and/or record buttons so the pressure roller applies from 2 1/2 to 3 1/2 lbs. pressure on the capstan.
	9. Tension pulley (113) not adjusted properly.	9. Tension pulley must be adjusted properly. See Adjustments).
	10. Head bar activating springs (62) off or broken.	10. Replace.
	11. Take-up bar actuator not adjusted properly.	11. See (Adjustments).
	12. Take-up driver (111) not engaging motor shaft.	12. Take up arm (21) must operate freely.
Take-up Reel does not revolve in Forward Position.	1. Button lever (71) not adjusted properly.	1. Button lever can be adjusted to make small deviations in torque (see No. 5).
	2. Activating Spring (19) loose or broken (forward).	2. Replace.
	3. Take-up belt (112) off pulleys.	3. Replace (see "Take up Reel does not revolve in Play or Record position").
	4. Take-up belt (112) worn.	4. Replace.
	5. Tension pulley (113) not adjusted properly.	5. In forward position, tension pulley should be adjusted so there is 5 to 7 ozs. of torque approximately 2 3/4 in. from the center of the reel.
	6. Brake sticking on supply reel disc.	6. Check that brake return springs are releasing brakes.
	7. Too much friction in counter (86).	7. Counter should turn freely without binding.
	8. Motor stalling.	8. Check that tension pulley (113) is adjusted properly (see No. 5).

SYMPTOM	CAUSE	REMEDY
	9. Tension pulley (113) not engaging take up belt.	9. Check that take up arm (101) is not binding on base-plate or take up rod (97).
Reels do not stop when stop button is de-pressed.	1. Button lever (71) not adjusted properly.	1. Button lever must be adjusted to release the brakes completely when another button is pushed.
	2. Brake activating hook (80) or spring (19) loose or broken.	2. Replace.
	3. Brake Assembly bind-ing.	3. Check if brake assembly operates freely.
	4. Tension pulley not ad-justed properly.	4. (See "Take up Reel does not revolve in Forward Position").
	5. Brakes worn.	5. Replace brake assembly (18).
	6. Take up arm (101) sticking.	6. Take up arm must operate freely.
Weak Output (Mech.)	1. Playback Head (35) not aligned properly, Azimuth.	1. Head should be aligned for maximum output using 1 mil. alignment tape and adjusting head nest.
	2. Playback head (35) not aligned properly, Ver-tical.	2. Head should be aligned so the top of the head pole piece is even with the top edge of the tape.
	3. Pressure Pad (48) not making proper con-tact with lead.	3. Pressure Pad (48) should make complete contact with head pole piece.
	4. Light pressure pad pressure.	4. Pressure pad must have from 12 to 18 grams pres-sure on head.
	5. Tape Guide (37) not adjusted properly.	5. Adjust tape guide (37) so tape feeds evenly through guide (46) and permanent tape guide.
	6. Defective Record Head (35).	6. Replace.
Take up Reel revolves fast when Play or Re-cord buttons are de-pressed.	1. Tab on pause brake lever (30) not adjust-ed properly.	1. Adjust pause brake lever so pressure roller (44) leaves capstan and take up reel stops simultaneously.
	2. Head bar bracket (40) too tight.	2. See (Adjustments).
	3. Button levers not ad-justed properly.	3. Button levers (71) must be adjusted so pressure roller (44) applies from 2 1/2 to 3 1/2 lbs. pres-sure on capstan in play or record position (measur-ing from under pressure roller on pressure roller stud.)
	4. Pressure roller (44) not aligned properly.	4. See (Adjustments).
Does not erase clean (mech).	1. Leads off Erase Head (34).	1. Replace.
	2. Tape Guide (37) not adjusted properly.	2. See (Weak Output).

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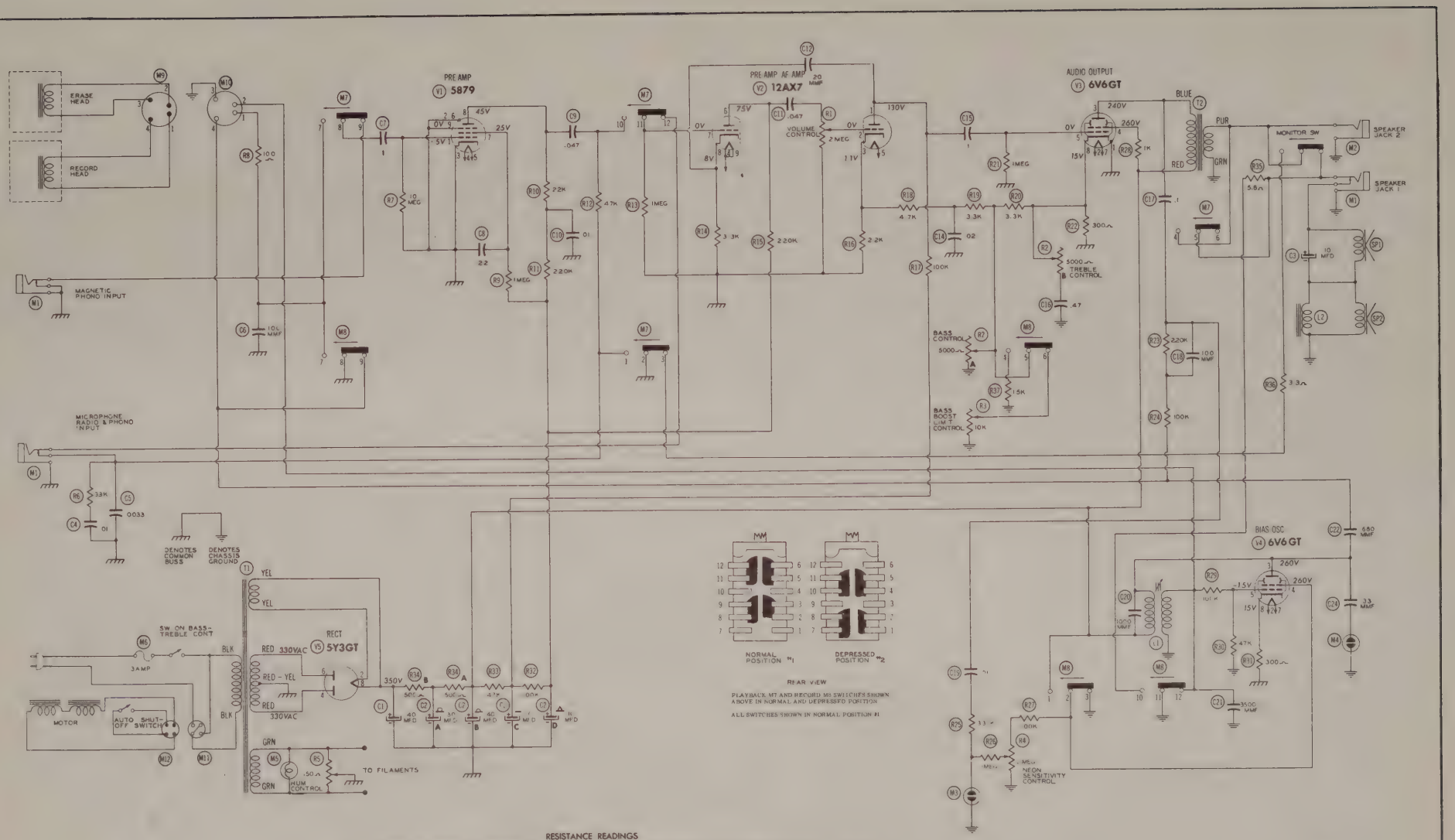
SYMPTOM	CAUSE	REMEDY
	3. Erase Head (34) not adjusted properly.	3. Erase Head should be adjusted so the top of the head pole piece is approximately .005 inch above the edge of the tape.
Supply Reel does not revolve in rewind position.	1. Loose reel shaft screw (1).	1. Tighten.
	2. "O" Ring (117) off drive pulleys.	2. Replace.
	3. Rewind driver (118) not engaging take-up driver (111).	3. Check that take-up rod (31) has not slipped out of rewind arm (108) or take-up arm (101).
	4. Button lever (71) not adjusted properly.	4. Rewind button lever (71) must be adjusted to have a minimum of 2 1/2 ozs. of toruqe approximately 2 3/4 inches from the center of the reel.
	5. Activating spring (19) loose (rewind).	5. Replace.
	6. Take-up driver (111) not engaging motor drive shaft.	6. See ("Take-up Reel does not revolve in Play or Record Position").
	7. Brake sticking on take-up pulley.	7. Check that brake arm assembly is free and not binding, also check that brake return springs are releasing brakes.
	8. Pause Brake on.	8. Release.
	9. Take-up Bar (101) not releasing take-up rod (31).	9. Check that take-up rod (97) is not binding or take-up rod (31) is not binding on take up bar (101).
	10. Oil on "O" Ring (117).	10. Remove all oil from "O" Ring and pulleys.
Does not shut off at the end of tape.	1. Defective switch.	1. Replace or repair.
	2. Switch wand catching on plastic escutcheon (13).	2. Position switch by loosening self taping screw (96).
Wow or Flutter (Record or Play Back).	1. Bump on take-up belt (112).	1. Replace.
	2. Safety Switch (95) applying too much pressure on tape.	2. Replace.
	3. Brakes Dragging.	3. (A) Adjust stop button lever (71) so brakes release completely. (B) Check that brake return springs (17) not loose or broken. (C) Brake arm assembly must be free and not binding. (D) Pause brake must release completely.
	4. Flat or bumpy pressure roller.	4. Replace.
	5. Capstan bearings not aligned properly.	5. Tap capstan slightly (bearings are self-aligning).



RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	5879	10Meg	0Ω	0Ω	40Ω	40Ω	0Ω	†1.1Meg	†390KΩ	0Ω
V 2	12AX7	†148KΩ	2Meg	2.2KΩ	40Ω	40Ω	†370KΩ	1Meg	3.3KΩ	40Ω
V 3	6V6GT	0Ω	40Ω	†1.5KΩ	†1KΩ	1Meg	INF	40Ω	300Ω	
V 4	6V6GT	0Ω	40Ω	†1KΩ	†1KΩ	30KΩ	INF	40Ω	300Ω	
V 5	5Y3GT	INF	150KΩ	INF	127Ω	INF	135Ω	INF	150KΩ	

† MEASURED FROM PIN 2 OF V5
ALL MEASUREMENTS TAKN IN RECORD POSITION

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MECHANICAL PARTS LIST

Ref. No.	Part No.	Description
1	8155	Reel Shaft Screw (R. H.)
1A	8272	Reel Shaft Screw (L. H.)
2	82	Int. Tooth Lockwasher
3	8010	Reel Disc
4	8140	Speed Control Knob
5	8256	Head Escutcheon Screw
6	8118	Head Escutcheon
7	8097	Small Counter Dial
8	8096	Large Counter Dial
9	8159	Escutcheon Screw
10	8094	Treble Control Knob
11	8093	Bass Control Knob
12	8092	Volume Control Knob
13	8117	Main Escutcheon
14	8214	Tri-Mount Stud
15	8069	Cover Plate
16	8296	Shoulder Screw
17	8138	Brake Return Spring
18	8297	Brake Arm Assembly
19	8173	Activating Spring
20	8398	Pal Nut
21	8013	Takeup Arm
22	8037	Rivet, Safety Sw. Release Lever
23	8293	Safety Switch Release Lever
24	8298	#6-32 Thread Cut. Mtg. Screw
25	8294	Safety Switch Release Wire
26	8048	Pause & Monitor Control Button
27	8178	Brake Shoe Assembly
28	8017	Pause Brake Activating Spring
29	4092	Shoulder Rivet
30	8044	Pause Brake Lever
31	8121	Takeup Rod
32	8078	Capstan Idler Return Spring
33	8087	Capstan Idler Cover Plate
34	12513	Erase Head
35	12512	Playback & Record Head
36	2300	#2-56 Hex. Nut
37	8143	Adjustable Tape Guide
38	8131	Head Adjusting Spring
39	8023	Head Nest
40	8147	Head Bar Bracket
41	3955	Head Bar Bracket Springs
42	1652	"C" Washer
43	8266	Fibre Washer
44	8123	Pressure Roller Assembly
45	8175	Tape Guide Mounting Screw
46	8045	Tape Guide
47	1588	"C" Washer
48	8067	Pressure Pad
49	8102	Pressure Pad Arm
50	8284	Erase Pressure Pad Arm Assy.
51	8066	Pressure Pad Spring
52	8061	Pressure Pad Release Rivet
53	8288	Pressure Pad Release Wire
54	2583	Fibre Washer
55	1719	"C" Washer
56	8164	Spring Washer
57	8026	Head Bar
58	8130	Head Bar Return Spring
59	8152	Head Bar Bracket Adj. Screw
60	2583	Fibre Washer
61	1652	"C" Washer-Reel Disc
62	8174	Head Bar Activating Spring
63	8036	Button Housing Assembly
64	8074	Control Button-Rewind, Stop, Play, or Forward
65	8261	Control Button-Record
66	8082	Latch Bar
67	8037	Rivet
68	8104	Record Button Interlock Lever
69	8281	Record Interlock Return Spring
70	8114	Control Button Lock Bar
71	8024	Button Lever
72	8124	Control Button Mtg. Screw
73	8022	Button Housing
74	8089	Control Button Shaft
75	1652	"C" Washer
76	1588	"C" Washer
77	8116	Button Stop Rod
78	8125	Button Return Spring
79	8128	Interlock Bar Return Spring
80	8285	Brake Activating Hook
81	6005	Pal Nut-Counter Mtg.
82	8031	Dust Shield
83	8001	Baseplate
84	5730	Adjustable Tape Guide Nut
85	8220	Monitor Switch
86	8046	Counter Assembly
87	8006	Reel Bearing
88	8130	Takeup Bar Actuator Spring
89	8076	Cam Link Spring Guide
90	2857	Cam Link Spring Tub. Rivets
91	8084	Capstan Bearing
92	8098	Capstan Bearing Plate
93	8133	Spring Washer
94	1588	"C" Washer
95	8038	Safety Switch
96	8298	#6-32 Self Tapping Screw
97	8041	Fast Forward Rod
98	8107	Control Rod Guide
99	8298	Control Rod Guide Mtg. Screw
100	8326	Takeup Bar Actuator
101	8025	Takeup Bar
102	3916	Tinnerman Nut
103	2583	Fibre Washer
104	8014	Bell Crank
105	8009	Brake Rod
106	8039	Speed Cam & Shaft Assembly
107	8029	Cam Link
108	8376	Rewind Arm
109	8079	Capstan Idler
110	8083	Capstan Pivot Arm
111	8018	Take-up Driver
112	8034	Take-up Belt
113	8103	Tension Pulley
114	8182	Right Hand Reel Pulley
115	8141	Counter Belt
116	8183	Left Hand Reel Pulley
117	8063	Rewind Belt (O Ring)
118	8106	Rewind Driver
119	8110	Flywheel & Capstan Assembly
120	8378	Sub-plate
121	8146	Sems Screw
122	8060	Rubber Motor Grommet
123	8015	Motor
124	8258	Ventilating Fan Spring
125	2279	Ventilating Fan Steel Washer
126	8263	Ventilating Fan Felt Washer
127	8255	Ventilating Fan
128	2269	Flat Washer
129	8035	Rewind Rod

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MODEL 321AM51-A-486

WELLS-GARDNER MODELS 321AM51-A-432,
321AM51-A-486, 2321AM51-A-488

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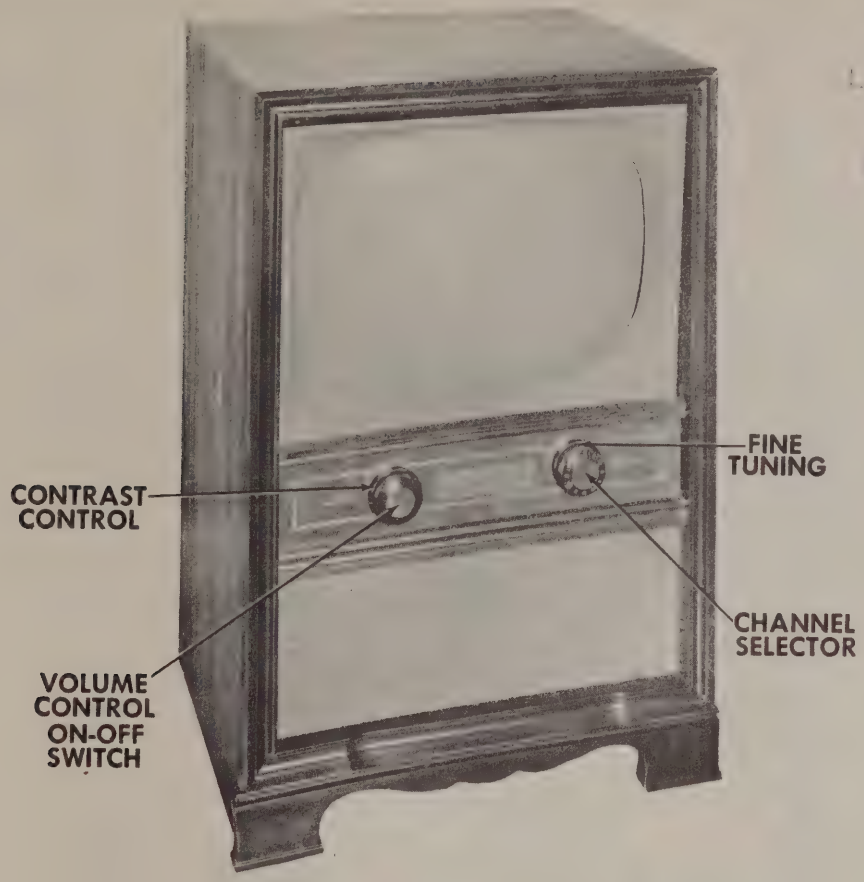

WELLS-GARDNER MODEL 321AM51-A-486

TRADE NAME	Wells-Gardner Models 321AM51-A-432, 321AM51-A-486, 2321AM51-A-488
MANUFACTURER	Wells-Gardner Co., 2701 N. Kildare Ave., Chicago 39, Illinois
TYPE SET	Television Receiver
TUBES	Twenty-three
POWER SUPPLY	110-120 Volts AC - 60 Cycles RATING 1.7 Amp. @ 117 Volts AC
TUNING RANGE	Channels 2 thru 13, Video IF 45.75MC, Sound IF 41.25MC (Intercarrier)

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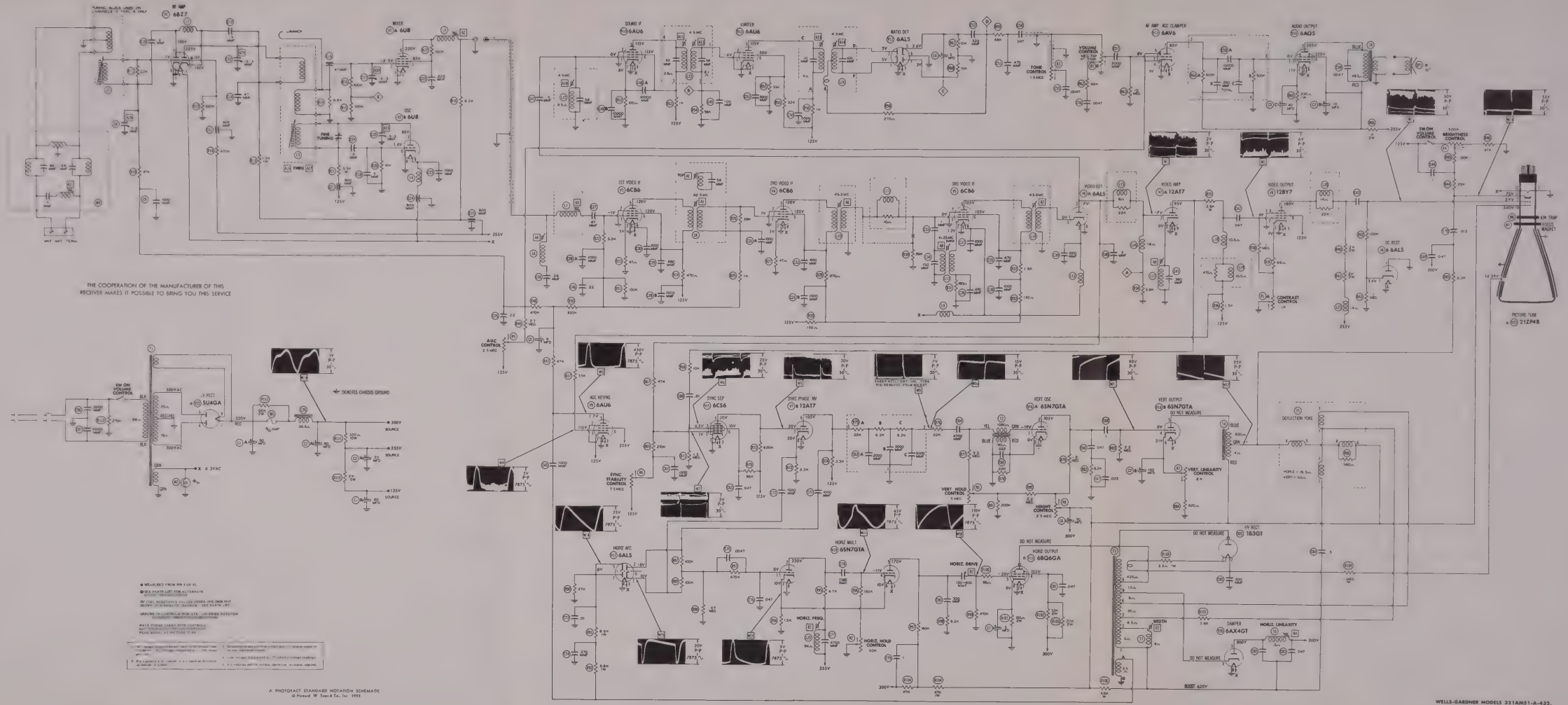
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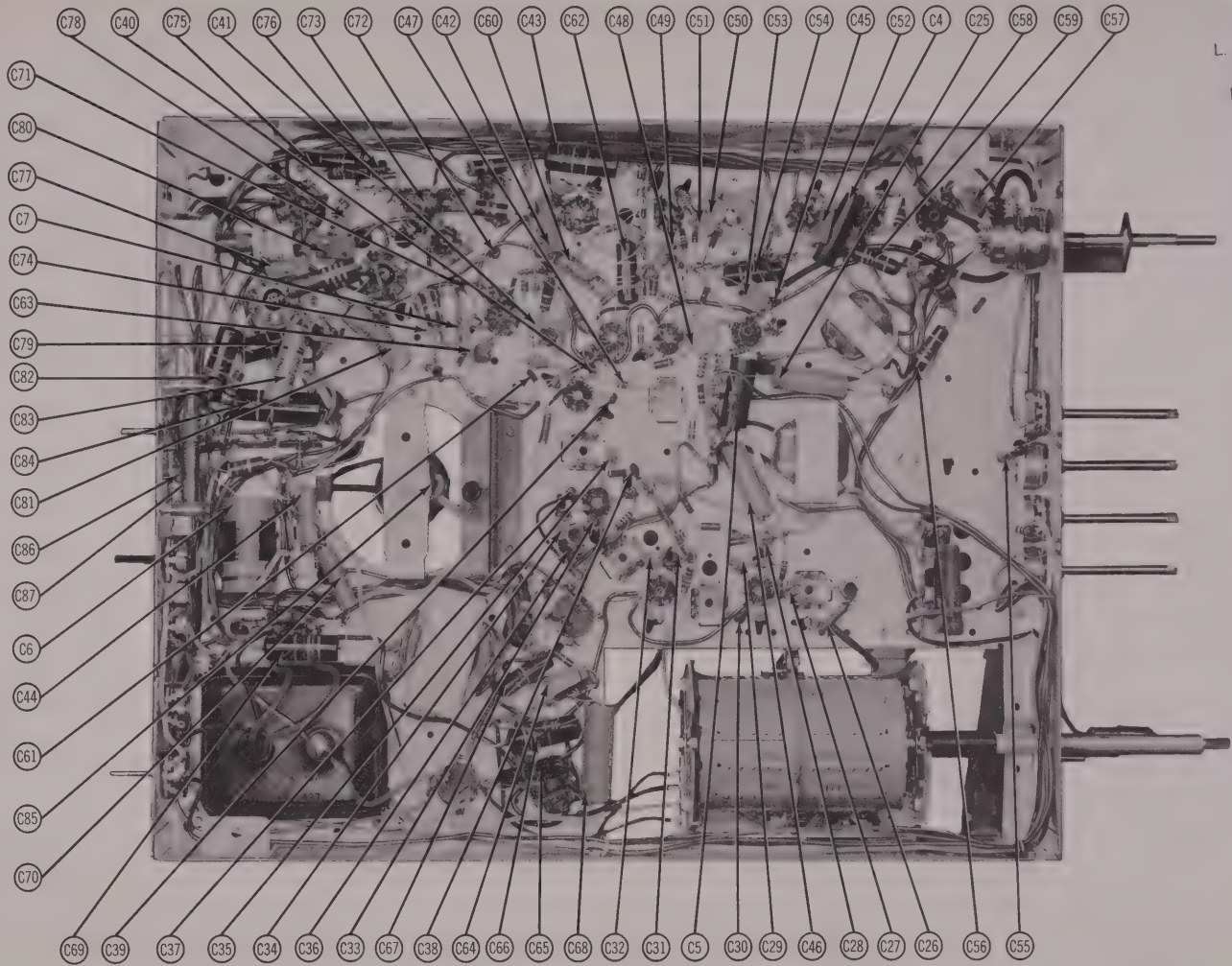

CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

TUBE PLACEMENT CHART

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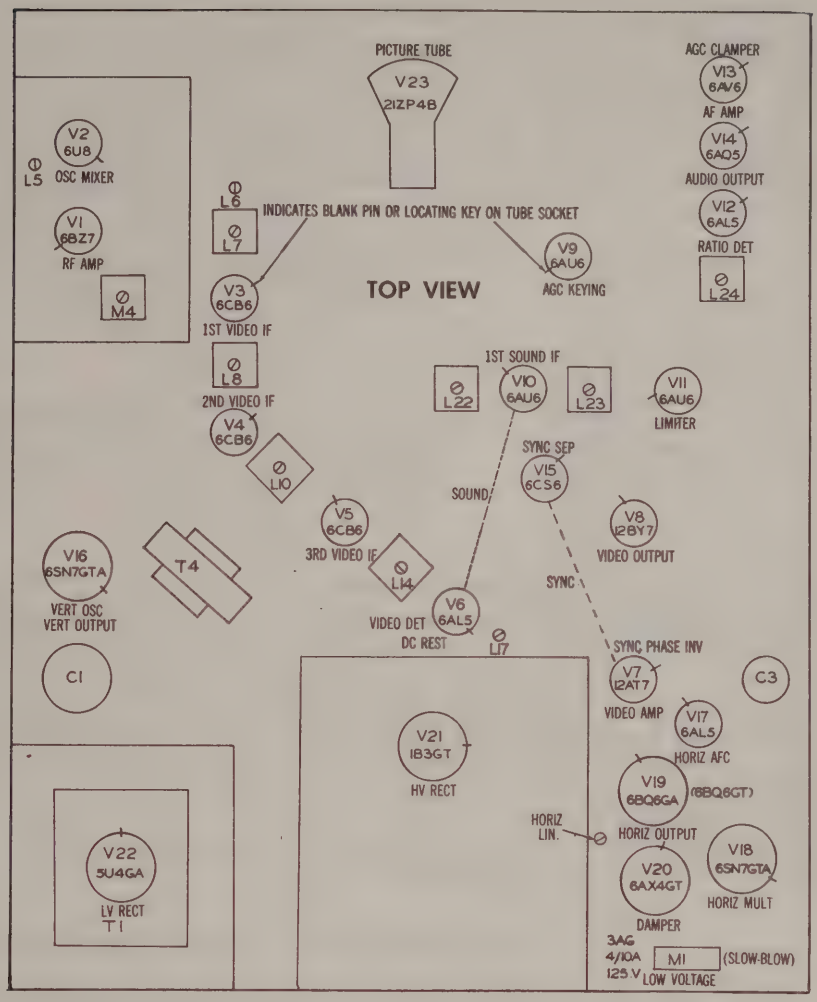

TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

POWER SUPPLY FAILURE
No raster, no sound - V22, Fuse (M1)

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V2, V3, V4, V5, V6
No pic, no sound, has snow - V1, V2, V3
No pic, has sound, has raster - V7, V8, V9, V23
Has pic, no sound - V10, V11, V12, V13, V14
Overloaded picture - V9, V13

SYNC FAILURE
No vert. sync - V7, V16
No horiz. sync - V7, V17, V18
No vert. or horiz. sync - V7, V15

SWEEP FAILURE
No raster, has sound - V18, V19, V20, V21, V23
No vertical deflection - V16
Poor vert. linearity or foldover - V16
Poor horiz. linearity or foldover - V18, V19, V20
Narrow picture - V18, V19, V20, V21, V22
Vert. off freq. - V7, V16
Horiz. off freq. - V7, V17, V18

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage lead should be securely taped and kept away from the chassis. Do not remove the horizontal oscillator tube to disable the high voltage.

VIDEO IF ALIGNMENT

Connect the negative lead of a 1.5 volt battery to the ungrounded side of C28A. Connect the positive lead to chassis.
Remove the RF amplifier tube (V1) from its socket.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	Direct	High side to an ungrounded tube shield floating over converter tube (V2). Low side to tuner chassis.	44MC (10MC Swp)	41.25MC 45.75MC 47.25MC	Any unused channel.	Vert. amp. thru detector (Fig. 1) to pin 5 (plate) of 6CB6 (V3). Low side to chassis.	A1, A2, A3, A4	Adjust A1 to place 47.25MC marker in trap notch as in Fig. 2. Adjust A2, A3 and A4 for response similar to Fig. 2. A2 and A3 affect the flat portion of curve. A4 positions the 41.25MC marker. Make sure 45.75MC marker is on peak as shown or 44.5MC marker on overall response will be incorrect.
2.	"	"	Not used.	42.5MC (Unmod)	"	Use VTVM. DC probe to point (A). Common to chassis.	A5	Increase bias from 1.5 volts to 4.5 volts at ungrounded side of C28A. Attenuate generator output to maintain 1 volt at VTVM. Adjuse for maximum deflection.
3.	"	"	"	45.3MC	"	"	A6	"
4.	"	"	"	43.9MC	"	"	A7	"
5.	"	"	"	41.25MC	"	"	A8	Adjust for MINIMUM deflection.
6.	"	"	44MC (10MC Swp)	41.25MC 42.25MC 42.5MC 43.9MC 44.5MC 45.3MC 45.75MC 47.25MC	"	Vert. amp. thru 10KΩ to point (A). Low side to chassis.		Check for response curve similar to Fig. 3. SLIGHTLY retouch A5 thru A8 to obtain desired response. If A1 thru A4 requires retouching, step 1 should be repeated.

4.5MC TRAP ALIGNMENT

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
7.	10KΩ	High side thru 10KΩ to pin 2 (plate) of 6AL5 (V6A). Low side to chassis.	Not used.	4.5MC (400∿ Mod)	Any unused channel.	Vert. amp. to pin 2 (grid) of picture tube. Low side to chassis.	A9	Adjust for MINIMUM 400∿ indication on scope.

ALTERNATE 4.5MC TRAP ALIGNMENT

Replace the RF amplifier tube (V1) and remove bias battery. Tune in a TV station and adjust A9 for minimum 4.5MC beat interference in picture.

SOUND IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Remove 6CB6 (V5) from its socket.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
8.	10KΩ	High side thru 10KΩ to pin 2 (plate) of 6AL5 (V6A). Low side to chassis.	4.5MC (Unmod)	Any	DC probe to point (B). Common to chassis.	A10, A11, A12	Adjust for maximum deflection.
9.	"	"	"	"	DC probe to point (C). Common to chassis.	A13	Use only enough generator output to provide usable indication on VTVM. Adjust for maximum deflection.
10.	"	"	"	"	DC probe to point (D). Common to chassis.	A14	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting. Replace V5 in its socket.

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Remove 6CB6 (V5) from its socket.
Use frequency modulated signal with 60∿ modulation and 450KC sweep. Use 120∿ sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
8.	10KΩ	High side thru 10KΩ to pin 2 (plate) of 6AL5 (V6A). Low side to chassis.	4.5MC (450KC Swp)	4.5MC	Any	Vert. amp. to point (B). Low side to chassis.	A10, A11, A12	Adjust for curve of maximum amplitude and symmetry similar to Fig. 4.
9.	"	"	"	"	"	Vert. amp. to point (C). Low side to chassis.	A13	Disconnect stabilizing capacitor C4. Use only enough sweep generator output to provide usable indication on scope. Adjust for curve of maximum amplitude and symmetry similar to Fig. 4.
10.	"	"	"	"	"	Vert. amp. to point (D). Low side to chassis.	A14	Reconnect stabilizing capacitor C4. Adjust so that 4.5MC occurs at center of crossover lines as in Fig. 5. SLIGHTLY retouch A13 for maximum amplitude and straightness of crossover lines. Replace V5 in its socket.

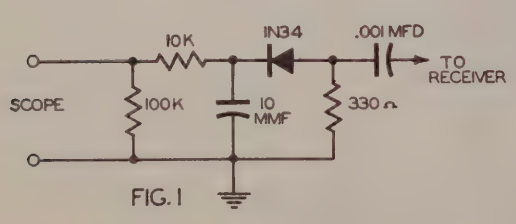

FIG. 1

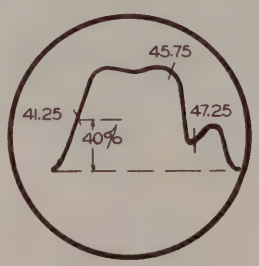

FIG. 2

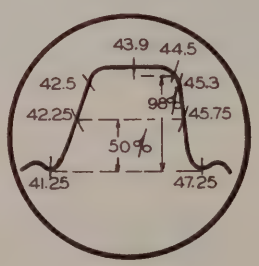

FIG. 3

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ALIGNMENT INSTRUCTIONS (cont)

OSCILLATOR ALIGNMENT

Connect the negative lead of a 4.5 volt battery to the ungrounded side of C28A. Positive lead to chassis.
Complete oscillator alignment may not be necessary. If the oscillator seems to be off frequency approximately the same amount for a majority of the channels, it may be possible to correct them in one step using A15 adjustment. It should be noted that this is an all channel oscillator circuit adjustment and should not be used to correct any individual channel. If adjustment of A15 will not bring all channels well within range of the fine tuning control, it will be necessary to adjust the channel strip adjustment screw for each channel that is off frequency. The channel oscillator adjustment screws are reached through a hole just to the left of the channel switch shaft. The correct adjustment screw is accessible through this hole as the channel switch is turned to each channel. Replace the RF amplifier (V1) in its socket.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
11.	Two 120Ω carbon resistors	Across VHF antenna terminals with 120Ω in each lead.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. amp. thru 10KΩ to point (A). Low side to chassis.	A16	Adjust to place sound marker in trap notch as in Fig. 6. Video marker should be at 50%.
			207MC (10MC Swp)	205.25MC 209.75MC	12		A17	
			201MC (10MC Swp)	199.25MC 203.75MC	11		A18	
			195MC (10MC Swp)	193.25MC 197.75MC	10		A19	
			189MC (10MC Swp)	187.25MC 191.75MC	9		A20	
			183MC (10MC Swp)	181.25MC 185.75MC	8		A21	
			177MC (10MC Swp)	175.25MC 179.75MC	7		A22	
			85MC (10MC Swp)	83.25MC 87.75MC	6		A23	
			79MC (10MC Swp)	77.25MC 81.75MC	5		A24	
			69MC (10MC Swp)	67.25MC 71.75MC	4		A25	
			63MC (10MC Swp)	61.25MC 65.75MC	3		A26	
			57MC (10MC Swp)	55.25MC 59.75MC	2		A27	

RF AND MIXER ALIGNMENT

Connect the negative lead of a 3 volt battery to the ungrounded side of C25. Connect the positive lead to chassis.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
12.	Two 120Ω carbon resistors	Across VHF antenna terminals with 120Ω in each lead.	207MC (10MC Swp)	205.25MC 209.75MC	12	Vert. amp. thru 10KΩ to point (E). Low side to chassis.	A28, A29 A30	Adjust for response similar to Fig. 7 with markers above 90%.
13.	"	"	213MC (10MC Swp)	211.25MC 215.75MC	13	"		If markers fall below 70% on any channel, make compromise adjustment of A28, A29 and A30 with channel switch set to that channel. Then check all other channels to see that they have not been seriously affected.
			201MC (10MC Swp)	199.25MC 203.75MC	11			
			195MC (10MC Swp)	193.25MC 197.75MC	10			
			189MC (10MC Swp)	187.25MC 191.75MC	9			
			183MC (10MC Swp)	181.25MC 185.75MC	8			
			177MC (10MC Swp)	175.25MC 179.75MC	7			
			85MC (10MC Swp)	83.25MC 87.75MC	6			
			79MC (10MC Swp)	77.25MC 81.75MC	5			
			69MC (10MC Swp)	67.25MC 71.75MC	4			
			63MC (10MC Swp)	61.25MC 65.75MC	3			
			57MC (10MC Swp)	55.25MC 59.75MC	2			

IF WAVE TRAP ADJUSTMENT

The IF wave trap should be tuned to minimize interference caused by signals which fall within the video IF bandpass (40-48MC). Tune in a station on which the interference is noted and adjust A31 for minimum interference in the picture.

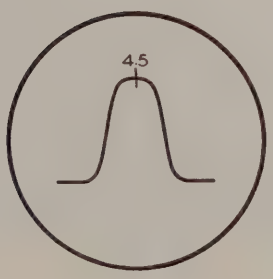


FIG.4

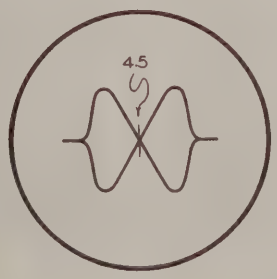


FIG.5

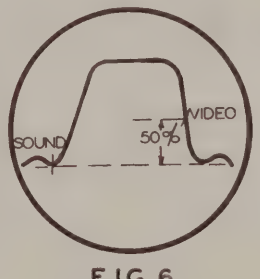


FIG.6

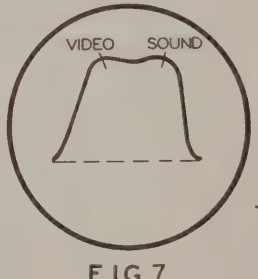
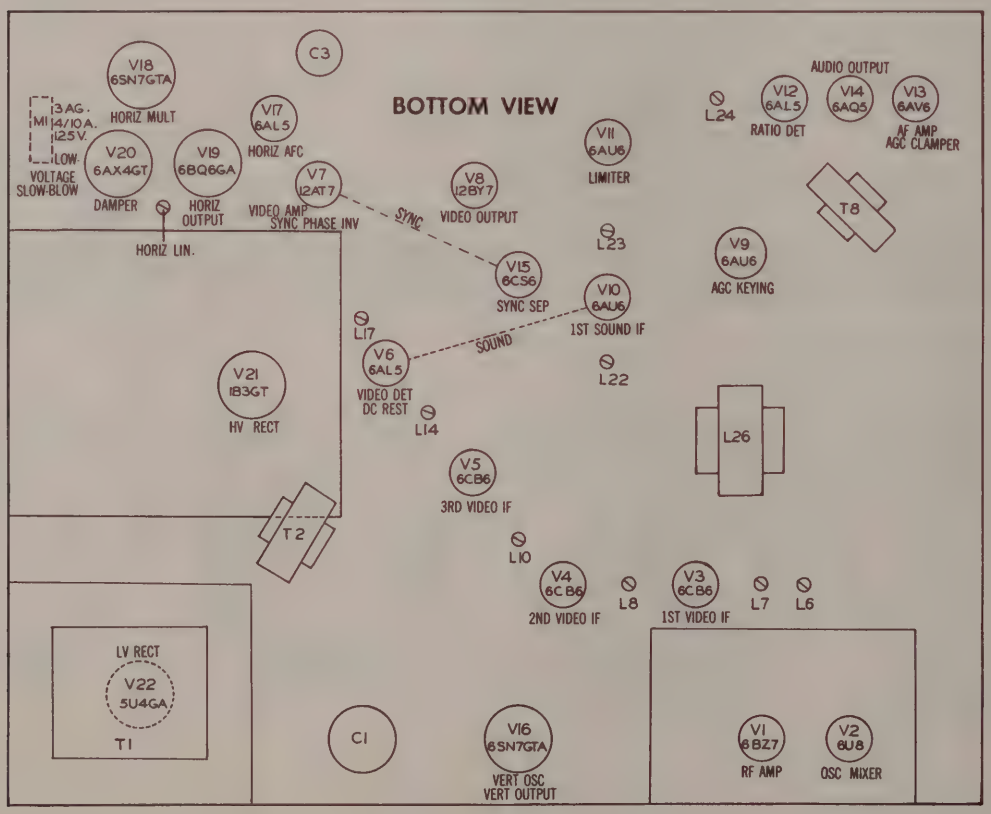


FIG.7

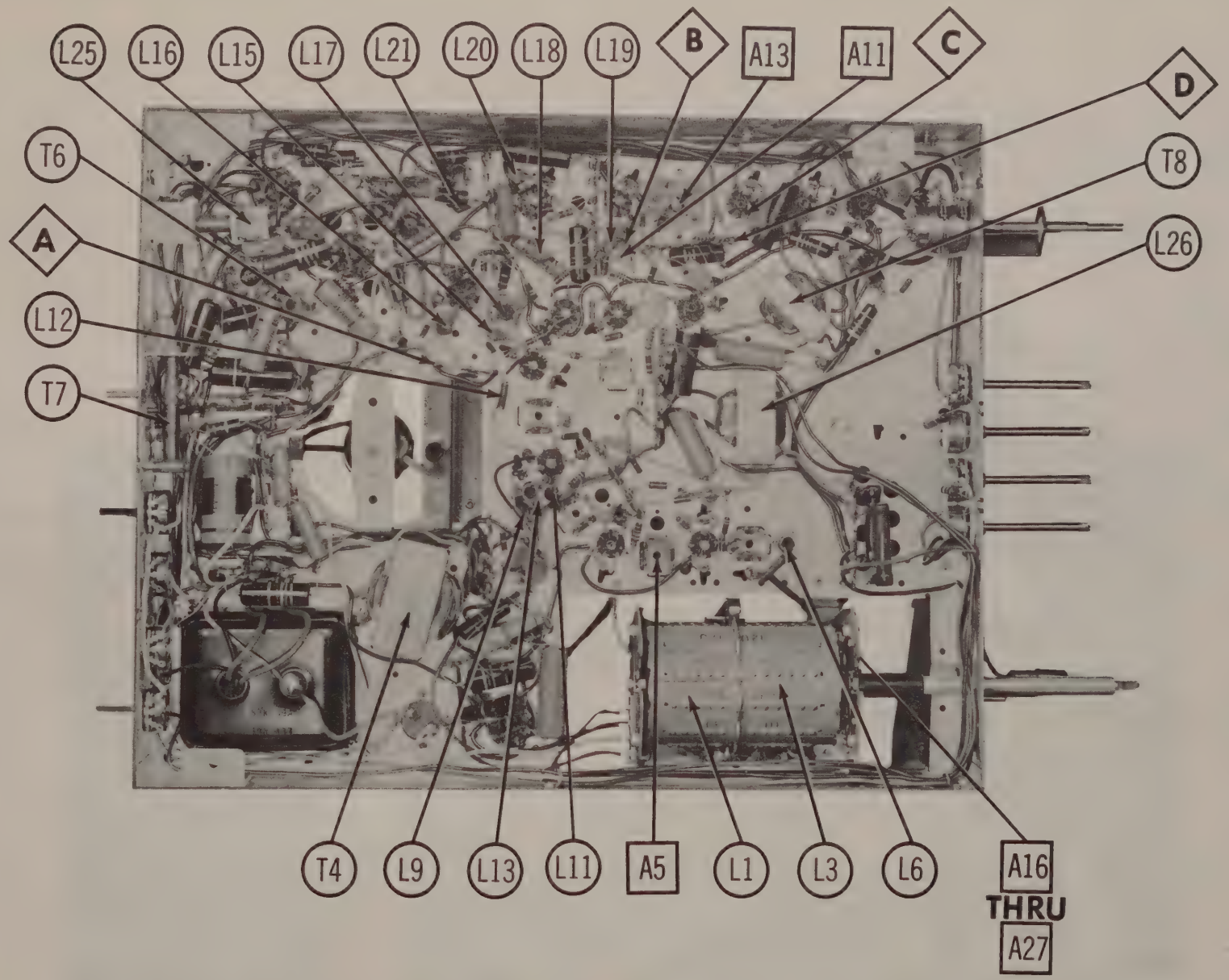
RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6BZ7	†1.8KΩ	†300KΩ	INF	0Ω	.1Ω	INF	750KΩ	0Ω	0Ω
V 2	6U8	†5.5KΩ	200KΩ	†100KΩ	.1Ω	0Ω	†8.5KΩ	0Ω	0Ω	10KΩ
V 3	6CB6	80KΩ	47Ω	0Ω	.1Ω	†2.8KΩ	†2.8KΩ	0Ω		
V 4	6CB6	80KΩ	47Ω	0Ω	.1Ω	†3KΩ	†3KΩ	0Ω		
V 5	6CB6	.2Ω	180Ω	0Ω	.1Ω	†4KΩ	†4KΩ	0Ω		
V 6	6AL5	1Meg	3.9KΩ	.1Ω	0Ω	.5Ω	0Ω	0Ω		
V 7	12AT7	†9KΩ	3.9KΩ	.2Ω	0Ω	0Ω	†5.5KΩ	†820KΩ	3.3KΩ	.1Ω
V 8	12BY7	450Ω	1Meg	0Ω	.1Ω	.1Ω	0Ω	†4.5KΩ	†2.5KΩ	0Ω
V 9	6AU6	†35KΩ	†2.3KΩ	.1Ω	0Ω	350KΩ	†400Ω	†2.3KΩ		
V 10	6AU6	6.5Ω	0Ω	0Ω	.1Ω	†3.3KΩ	†3.3KΩ	100Ω		
V 11	6AU6	56KΩ	0Ω	.1Ω	0Ω	†3.3KΩ	†27KΩ	0Ω		
V 12	6AL5	INF	INF	.1Ω	0Ω	10KΩ	0Ω	10KΩ		
V 13	6AV6	10Meg	0Ω	.1Ω	0Ω	750KΩ	750KΩ	†500KΩ		
V 14	6AQ5	500Ω	330Ω	0Ω	.1Ω	†1.8KΩ	†1.3KΩ	500KΩ		
V 15	6CS6	40KΩ	0Ω	.1Ω	0Ω	†820KΩ	†70KΩ	1.5Meg		
V 16	6SN7GTA	4Meg	▲2.5Meg	190Ω	2.2Meg	▲8.5KΩ	2.2KΩ	0Ω	.1Ω	
V 17	6AL5	4.8Meg	4.8Meg	.1Ω	0Ω	8.5KΩ	NC	8.5KΩ		
V 18	6SN7GTA	5Meg	†5KΩ	1.5KΩ	180KΩ	†200KΩ	1.5KΩ	.1Ω	0Ω	
V 19	6BQ6GA	TP	0Ω	TP	†15KΩ	470KΩ	TP	.1Ω	100Ω	Top Cap ▲15Ω
V 20	6AX4GT	TP	NC	120KΩ	TP	†55Ω	NC	.1Ω	0Ω	
V 21	1B3GT		PINS	1 - 8	HAVE	INFINITE	RESISTANCE			Top Cap ▲435Ω
V 22	5U4GA	INF	30KΩ	INF	20Ω	INF	19Ω	INF	30KΩ	
V 23	21ZP4B	0Ω	1.1Meg	Pin 10 ▲6.8KΩ	Pin 11 †250KΩ	Pin 12 .1Ω				

† MEASURED FROM PIN 2 OF V22.
▲ MEASURED FROM PIN 3 OF V20.
TP - TIE POINT
NC - NO CONNECTION



TUBE PLACEMENT CHART



CHASSIS BOTTOM VIEW-TRANS., INDUCTOR AND ALIGNMENT IDENTIFICATION

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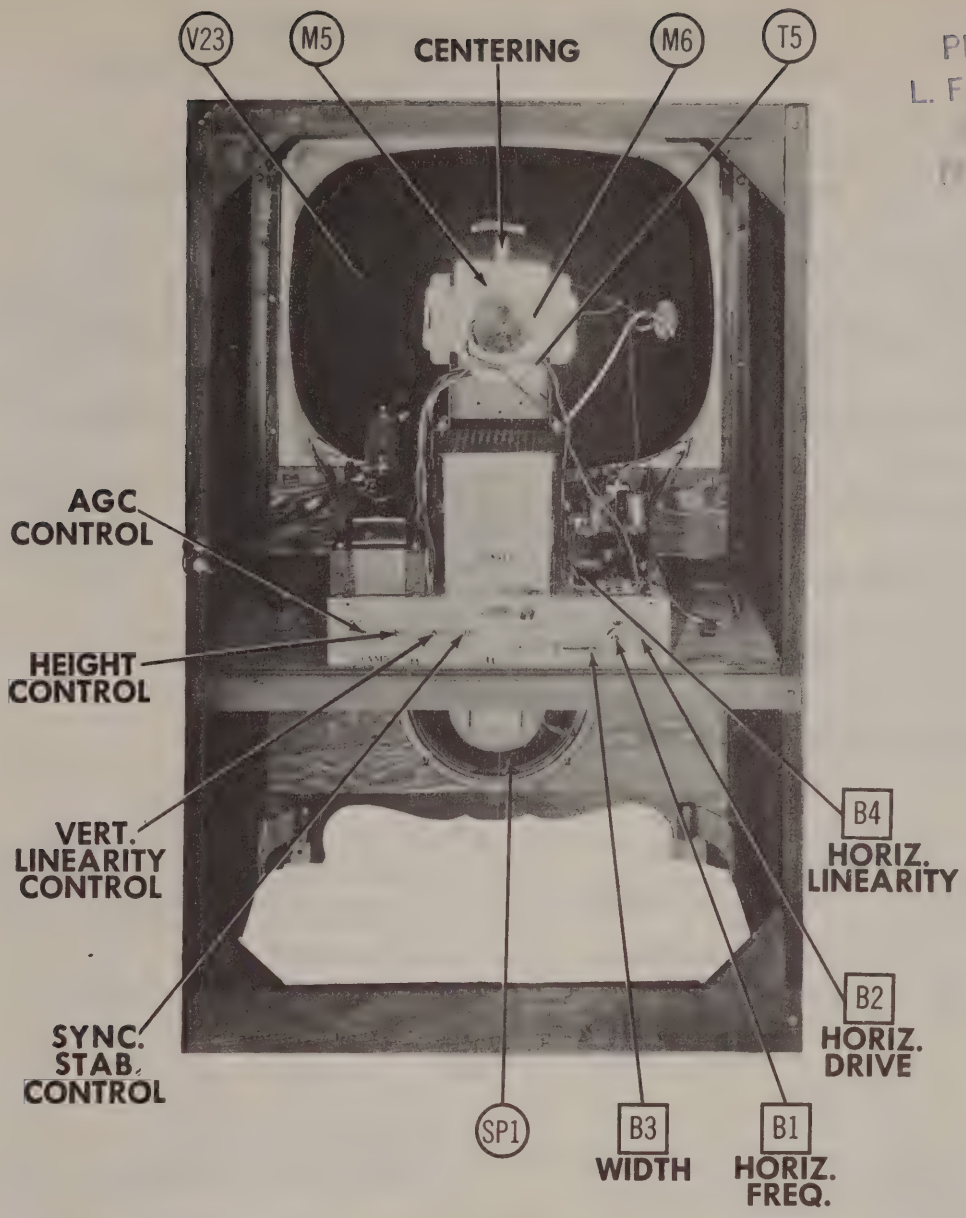

CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern. If horizontal hold control fails to maintain sync, set it in the middle of its range and adjust the horizontal frequency slug B1 until the picture is in sync.

Check other channels and if necessary, readjust B1 slightly for best sync on all channels. With picture locked in sync, turn contrast control (R1A) to minimum, adjust brightness control for a washed-out picture.

Adjust the width control (B3) for a picture slightly wider than necessary to fill mask horizontally.

Turn horizontal drive trimmer (B2) inward (if necessary) until horizontal drive line disappears.

Adjust horizontal linearity slug (B4) for a picture that is symmetrical from left to right. Adjust the picture centering device located in front of focus magnet to center picture in the mask.

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage".

INSUFFICIENT SWEEP

Check by substitution V19, V20 and V22. Check adjustments B2, B3 and B4. Check T3, T5A, R102, R103, C80, C7 and other associated components.

DRIVE LINES

Check by substitution V19 and V20. Check adjustments B2 and B4. Check R102, R103, T3, T5A and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V19 and V20. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines".

PIE CRUST EFFECT

Check by substitution V18, V19 and V20. Check C76 for open. Check L25, C77, C75, R94 and other associated components.

XMAS TREE EFFECT

Check by substitution V18, V19 and V20. Check T3 and T5 for internal arcing. Check C74, C73, C77, C78, L25, R91, R92, R96 and other associated components.

VERTICAL

LOSS OF SWEEP

Substitute V16. Check waveform W11.

If Satisfactory	If Unsatisfactory
Check T4, T5B, R84, C2B and other associated components.	Check C66, C68, R79, R8, R106, R77, T2 and other associated components.

INSUFFICIENT SWEEP

Substitute V16. Check height and vertical linearity controls for proper operation. Check R79, T4 and other associated components.

COMPRESSED AT BOTTOM

Substitute V16. Check R106, R8, R79, C68, T2 and other associated components.

COMPRESSED AT TOP

Substitute V16. Check R84, R7, C2B, C68, T4 and other associated components.

FOLDS

Substitute V16. Check C66, C67, C68, R82 and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Check by substitution V15 and V7. Check C60, C62, R68, R70, R72, R74 and other associated components.

LOSS OF VERTICAL SYNC - HORIZONTAL SYNC SATISFACTORY

Substitute V16. Check vertical integrator network. Check R77, R5, R78, T2, C64 and other associated components.

LOSS OF HORIZONTAL SYNC - VERTICAL SYNC SATISFACTORY

Check by substitution V17 and V18. Check horizontal AFC network. Check C71, C72, L25, R96, R2, R94 and other associated components.

HORIZONTAL BENDING

Check by substitution V7, V15, V17 and V18. Check horizontal AFC network.

VIDEO

LOSS OF VIDEO

Check by substitution V7 and V8. Check C42, C43, R35, R36, R40, R41, L18, L21 and other associated components.

SOUND BARS (4.5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check adjustment A9. Check video IF alignment.

POOR CONTRAST

Check by substitution V7 and V8. Check contrast control. Check L19, L20, L15, C42, C43 and other associated components.

NEGATIVE PICTURE

Check by substitution V7 and V8. Check picture tube. Check L16, L19, L20, C42, C43, R39 and other associated components.

SMEAR

Check by substitution V7 and V8. Check L15, L16, L19, L20, C42, C43 and other associated components.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V1, V3, V4, V5, V6, V7 and V8 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V10, V11, V12, V13 and V14. Check stages V13 and V14 using audio signal generator. Apply audio signal across R1B.

If Satisfactory	If Unsatisfactory
Check ratio detector and audio IF stages for component failure or change of value.	Check C54, C57, C58A, C59, C3C, C3B, R66, R64A, T8, speaker and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustment A14 for minimum buzz. If still unsatisfactory, check audio IF alignment.

DISTORTED

Follow procedure outlined under "Weak or No Sound".

POWER

DEAD SET

If filaments fail to light, check AC interlock assembly. Check switch on volume control and T1. If filaments light, check M1 fuse. Substitute V22. Check B+ filter and decoupling network.

SMALL AND/OR DIM PICTURE

Substitute V22. Check B+ filter and decoupling network.

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[illegible] LEADE ST.
DEN[illegible], COLORADO

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: Wells-Gardner PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amp.	6BZ7	6BZ7	9AJ	
V2	Mixer-Osc.	6U8	6U8	9AE	
V3	1st Video IF Amp.	6CB6	6CB6	7CM	
V4	2nd Video IF Amp.	6CB6	6CB6	7CM	
V5	3rd Video IF Amp.	6CB6	6CB6	7CM	
V6	Video Det-DC Restorer	6AL5	6AL5	6BT	
V7	Video Amp-Sync Phase Inv.	12AT7	12AT7	9A	
V8	Video Output	12BY7	12BY7	9BF	
V9	AGC Keying	6AU6	6AU6	7BK	
V10	1st Sound IF Amp.	6AU6	6AU6	7BK	
V11	Limiter	6AU6	6AU6	7BK	
V12	Ratio Det	6AL5	6AL5	6BT	
V13	AF Amp-AGC Clamper	6AV6	6AV6	7BT	
V14	Audio Output	6AQ5	6AQ5	7BZ	
V15	Sync Sep.	6CS6	6CS6	7CH	
V16	Vert. Osc. Vert. Output	6SN7GTA	6SN7GTA	8BD	
V17	Horiz. AFC	6AL5	6AL5	6BT	
V18	Horiz. Mult.	6SN7GTA	6SN7GTA	8BD	
V19	Horiz. Output	6BQ6GA	6BQ6GA	6AM	6BQ6GT used as an alternate
V20	Damper	6AX4GT	6AX4GT	4CG	
V21	HV Rectifier	1B3GT	1B3GT	3C	
V22	LV Rectifier	5U4GA	5U4GA	5T	5U4G used as an alternate

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA: Wells-Gardner PART No.	CBS PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.	RETMA BASE TYPE	NOTES
V23	21ZP4B ①	21ZP4B ① 21ZP4A	21ZP4B ① 21ZP4A	21ZP4B③ 21ZP4A 21ZP4 ②	21ZP4B ① 21ZP4A	12N 12N	① Aluminized ② Circuit change necessary. ③ Silver Screen.

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA: Wells-Gardner PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C1A	▲80	400	45X390			FP229.4	TM-D80-450	T-180	
B	▲60	400							
C2A	▲80	400	45X391			FP229.8	TM-3057	T-720	
B	▲100	50							
C3A	■20	400	45X392			FP366	TM-3037	T-700	
B	▲10	400							
C	40	50							
C4	5	25	45X378			TC30	TD-5-25	MMT-0505	
C5	4	100	45X361			TC40	TD-4-150	FM-1504	
C6	30	400	45X393			TC77	TD-30-450	FM-4530	
C7	5	25	45X378			TC30	TD-5-25	MMT-0505	
C8	3-9		31A-079	829-10					
C9	1000		13L-8X102Z	DD-102	801-001	DC-521			
C10	3		13L-8C030K	TCZ-3	NP0A-030	ZT-5533			
C11	800		13M-28N102Z-03						
C12	.5-3		31A-056-1	829-3	3115-01-0R5	CT-565A			
C13	1.5		13L-8C1R5C	TCZ-1.5	NP0A-1R5	ZT-5515			
C14	47		13L-8Q470K	D6-470	831-470	UC-5447			
C15	800		13M-28N102Z-03						
C16	47								
C17	.5-3		31A-056-1	829-3	3115-01-0R5	CT565A			
C18	5		13L-8UA050C						
C19	10		13L-8T100A						
C20	.5-3		31A-056-1	829-3	3115-01-0R5	CT565A			
C21	800		13M-28N102Z-03						
C22	220		13L-12D221K	D6-221	811-221	UC-5322			
C23	1000		13L-8X102Z	DD-102	801-001	DC-521			
C24	800		13M-28N102Z-03						
C25	.22	200	RCP10M2224M			PT4022	IMP2-P22	3302022	
C26	36		47X626						
C27	47		47X603	D6-470	GP1K-470	UC-5447		K-1447	
C28A	1000		80X3	DD2-102	812-001	DCD-521			
B	1000								
C29	680		80X5	DD-681	811-681	UC-5368			
C30	1000		80X1	DD-102	801-001	DC-521			
C31A	1000		80X3	DD2-102	812-001	DCD-521			
B	1000								
C32	680		80X5	DD-681	811-681	UC-5368			
C33	1		47X588	TCZ-1	NP0A-010				
C34	150	500	RCM15E151K	TCZ-150	NP0-334-151	MCB236		KR-1315	
C35	470		80X4	DD-471	831-471	UC-5347		K-1347	
C36	470		80X4	DD-471	831-471	UC-5347		K-1347	
C37	1000		80X1	DD-102	801-001	DC-521			
C38	1000		80X1	DD-102	801-001	DC-521			
C39	1000		80X1	DD-102	801-001	DC-521			
C40	5		47X562	TCZ-5	NP0A-050	ZT-555			
C41	360	500	47X568					KR-1336	
C42	.047	400	RCP10M4473M	DF-503		PT4147	IMP4-S47	3304147	
C43	.1	400	RCP10M4104M	DF-104		PT401	IMP4-P1	330401	
C44	.1	200	RCP10M2104M	DF-104		PT401	IMP2-P1	330401	
C45	1000		80X1	DD-102	801-001	DC-521	IMP6-D1	K-1210	
C46	.22	200	RCP10M2224M			PT4022	IMP2-P22	3302022	
C47	1.5		47X584	TCZ-1.5	NP0A-1R5	ZT-5515			
C48A	10000		80X6	DD3-103	811-01	DC-511			
B	10000				811-01	DC-511			
C49	100		47X604	D6-101	GP1K-101	UC-531		K-1310	
C50	5000		47X507	DD-502	811-005	DC-525		C-1250	
C51	5000		47X507	DD-502	811-005	DC-525		C-1250	
C52	330	500	47X570	D6-331	GP2K-331	UC-5333		K-1333	
C53	470	500	47X525	D6-471	GP2K-471	UC -5347		K-1347	
C54	.047	200	RCP10M2473M	DF-503		PT4147	IMP2-S47	3302147	
C55	.0047	400	RCP10M4472M	D6-472	GP2-333-472	PT6247	IMP6-D47	3306247	

CAPACITORS (cont)

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA Wells-Gardner PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C56	.0047	400	RCP10M4472M	D6-472	GP2-333-472	PT6247	IMP6-D47	3306247	
C57	5000		47X507	DD-502	811-005	DC-525	IMP6-D5	C-1250	
C58A	10000								
B	250		†76X5	†PC-80	†1404-01				
C									
C59	.0047	600	RCP10M6472M	D6-472	GP2-333-472	PT6247	IMP6-D47	3306247	
C60	.01	400	RCP10M4103M	D6-103	GP2-333-103	PT411	IMP4-S1	330411	
C61	1000		80X1	DD-102	801-001	DC-521	IMP6-D1	K-1210	
C62	.047	400	RCP10M4473M	DF-503		PT4147	IMP4-S47	3304147	
C63A	2000					DC-522	IMP6-D2	C-1220	
B	5000		♦76X7	♦PC-100	♦1405-01	DC-525	IMP6-D5	C-1250	
C	5000					DC-525	IMP6-D5	C-1250	
C64	4700	500	47X543			MCB465		CR-1247	
C65	.022	200	RCP10M2223M	DF-203	817-02	PT4122	IMP4-S22	3304122	
C66	.047	600	RCP10M6473M	DF-503		PT6147	IMP6-S47	3306147	
C67	.022	200	RCP10M2223M	DF-203	817-02	PT4122	IMP4-S22	3304122	
C68	.1	600	RCP10M6104M	DF-104		PT601	IMP6-P1	330601	
C69	.047	600	RCP10M6473M	DF-503		PT6147	IMP6-S47	3306147	
C70	.015	600	RCP10M6153M			PT6115	IMP6-S15	3306115	
C71	1000		80X1	DD-102	801-001	DC-521	IMP6-D1	K-1210	
C72	1000		80X1	DD-102	801-001	DC-521	IMP6-D1	K-1210	
C73	.01	400	RCP10M4103M	D6-103	GP2-333-103	PT411	IMP4-S1	330411	
C74	270	500	RCM20A271K	D6-271	GP2K-271	MC241		K-1327	
C75	.0047	400	RCP10M4472M	D6-472	GP2-333-472	PT6247	IMP6-D47	3306247	
C76	.047	200	RCP10M2473M	DF-503		PT4147	IMP2-S47	3302147	
C77	4700	500	47X543			MCB465		CR-1247	
C78	390	500	RCM20B391J			MCB243		KR-1339	
C79	.1	400	RCP10M4104M	DF-104		PT401	IMP4-P1	330401	
C80	330	500	47X570					KR-1333	
C81	.047	400	RCP10M4473M	DF-503		PT4147	IMP4-S47	3304147	
C82	.1	400	RCP10M4104M	DF-104		PT401	IMP4-P1	330401	
C83	.047	400	RCP10M4473M	DF-503		PT4147	IMP4-S47	3304147	
C84	.15	400	RCP10M4154M			PT4015	IMP4-P15	3304115	
C85	500	20000	47X560	TV3-502	413	HV-20035A			
C86	10000		47X615	DD-103	811-01	DC-511	IMP6-S1	330611	
C87	10000		47X615	DD-103	811-01	DC-511	IMP6-S1	330611	

† Items C58A, C58B, C58C, R64A and R64B are combined in one unit.
When replacing items separately C58B and C58C should total 250MMF.
♦ Items C63A, C63B, C63C, R75A, R75B, and R75C are combined in one unit.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA Wells-Gardner PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1000Ω	½	B78X21	*QJ-638	RTV-502	F1-4	UF13L	Contrast - Panel
B	1Meg	½				R2-59	UR16-T254	Volume tapped at 250KΩ - Rear
C	Switch					KB-2	US-27	Attach to R1B
R2A	50KΩ	½	B40X361-C	Q11-123	A47-50K-S	AB-31	U-35	Horiz. Hold
B	Shaft		Not Req.	NQ	RS-3/16	AK-4	Not Req.	Attach to R2A
R3A	1. 5Meg	½	B40X334-E	Q11-138	A47-1.5Meg-S	AB-75	U-155	Tone
B	Shaft		Not Req.	NQ	RS-3/16	AK-4	Not Req.	Attach to R3A
R4A	500KΩ	½	B40X333-A	Q11-133	A47-500K-S	AB-59	U-50	Brightness
B	Shaft		Not Req.	Not Req.	RS-3/16	AK-8	Not Req.	Attach to R4A
R5A	1. 5Meg	½	B40X334-E	Q11-138	A47-1.5Meg-S	AB-75	U-155	Vert. Hold
B	Shaft		Not Req.	NQ	RS-3/16	AK-4	Not Req.	Attach to R5A
R6A	7. 5Meg	½	B40X370A	Q11-142	A47-7.5Meg-S	AB-89	U-82	Sync Stability
B	Shaft		Not Req.	Not Req.	FKS-1/4	AK-4	Not Req.	Attach to R6A
R7A	8000Ω	½	B40X375	Q11-116	A47-10K-S	AB-14	SU-20	Vert. Linearity
B	Shaft		Not Req.	RQ	FKS-1/4	AK-1	Not Req.	Attach to R7A
R8A	2. 5Meg	½	B40X369A	Q11-239	A47-2.5Meg-S	AB-83	SU-565	Height
B	Shaft		Not Req.	RQ	FKS-1/4	AK-4	Not Req.	Attach to R8A
R9A	2. 5Meg	½	B40X369A	Q11-239	A47-2.5Meg-S	AB-83	SU-565	AGC
B	Shaft		Not Req.	RQ	FKS-1/4	AK-4	Not Req.	Attach to R9A

* CONCENTRIKIT EQUIVALENT: KIT K-4, BASE ELEMENTS & SHAFTS: B11-108 & P6-218 (PANEL)
B13-137X & R16-313 (REAR)
76-2 SWITCH

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Wells-Gardner PART No.	IRC PART No.	NOTES
R10	47KΩ	½		BTS-47K	
R11	22KΩ	½		BTS-22K	
R12	820KΩ	½		BTS-820K	
R13	1500Ω	1		BTA-1500	
R14	470KΩ	½		BTS-470K	
R15	100KΩ	½		BTS-100K	
R16	100KΩ	½		BTS-100K	
R17	100KΩ	½		BTS-100K	
R18	8200Ω	½		BTS-8200	
R19	6800Ω	½		BTS-6800	
R20	10KΩ	½		BTS-10K	
R21	3300Ω	1		BTA-3300	
R22	3300Ω 5%	½		BTS-3300 5%	
R23	47Ω 5%	½	B83470	BTS-47 5%	
R24	470Ω	½	B85471	BTS-470	
R25	1000Ω	½	B85102	BTS-1000	
R26	39KΩ 5%	½	B83393	BTS-39K 5%	
R27	47Ω 5%	½	B83470	BTS-47 5%	
R28	470Ω	½	B85471	BTS-470	
R29	150Ω	½	B85151	BTS-150	
R30	39KΩ 5%	½	B83393	BTS-39K 5%	
R31	180Ω	½	B84181	BTS-180	
R32	1500Ω	½	B84152	BTS-1500	
R33	150Ω	½	B85151	BTS-150	
R34	3900Ω 5%	½	B83392	BTS-3900 5%	
R35	5600Ω	1	C84562	BTA-5600	
R36	1500Ω	½	B84152	BTS-1500	
R37	33KΩ	½	B84333	BTS-33K	
R38	1Meg	½	B84105	BTS-1Meg	
R39	68Ω	½	B84680	BTS-68	
R40	2000Ω 5%	2	D83202	BTB-2000 5%	
R41	2000Ω 5%	2	D83202	BTB-2000 5%	
R42	100KΩ	½	B84104	BTS-100K	
R43	1Meg	½	B84105	BTS-1Meg	
R44	22KΩ	½	B84223	BTS-22K	
R45	100KΩ	½	B85104	BTS-100K	
R46	47KΩ	½	B85473	BTS-47K	
R47	47KΩ	½	B84473	BTS-47K	
R48	470KΩ	½	B84474	BTS-470K	
R49	2. 7Meg	½	B84275	BTS-2. 7Meg	
R50	330KΩ	½	B83334	BTS-330K	
R51	100KΩ	½	B84104	BTS-100K	
R52	100Ω	½	B84101	BTS-100	
R53	1000Ω	½	B85102	BTS-1000	
R54	56KΩ	½	B84563	BTS-56K	
R55	33KΩ	½	B84333	BTS-33K	
R56	1000Ω	½	B85102	BTS-1000	
R57	33KΩ	½	B84333	BTS-33K	
R58	270Ω	½	B84271	BTS-270	
R59	68KΩ	½	B84683	BTS-68K	
R60	10KΩ 5%	½	B83103	BTS-10K 5%	
R61	10KΩ 5%	½	B83103	BTS-10K 5%	
R62	68KΩ	½	B84683	BTS-68K	
R63	10Meg	½	B85106	BTS-10Meg	
R64A	500KΩ	½		BTS-470K	
B	500KΩ	½	†76X5	BTS-470K	
R65	330Ω	1	C84331	BTA-330	
R66	1000Ω	2	D84102	BTB-1000	
R67	47KΩ	½	B84473	BTS-47K	
R68	10KΩ	½	B84103	BTS-10K	
R69	270KΩ	½	B84274	BTS-270K	
R70	68KΩ	½	B84683	BTS-68K	

PARTS LIST AND DE

RESIST

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Wells-Gardner PART No.	IRC PART No.	NOTES
R71	1. 5Meg	½	B84155	BTS-1. 5Meg	
R72	820KΩ	½	B84824	BTS-820K	
R73	3300Ω 5%	½	B83332	BTS-3300 5%	
R74	3300Ω 5%	½	B83332	BTS-3300 5%	
R75A	22KΩ	½		BTS-22K	
B	8200Ω	½	♦76X7	BTS-8200	
C	8200Ω	½		BTS-8200	
R76	22KΩ	½	B84223	BTS-22K	
R77	3.3Meg 5%	½	B84335	BTS-3.3Meg 5%	
R78	22KΩ	½	B84223	BTS-22K	
R79	1. 8Meg	½	B84185	BTS-1. 8Meg	
R80	2. 2Meg	½	B84225	BTS-2. 2Meg	
R81	200KΩ 5%	½		BTS-200K 5%	
R82	8200Ω	½	B84822	BTS-8200	
R83	2. 2Meg	½	B84225	BTS-2. 2Meg	
R84	820Ω	½	B84821	BTS-820	
R85	2200Ω	½	B84222	BTS-2200	
R86	560Ω	½		BTS-560	
R87	100KΩ	½	B84104	BTS-100K	
R88	4. 7Meg	½	B85475	BTS-4. 7Meg	
R89	100KΩ	½	B84104	BTS-100K	
R90	27KΩ	½	B84273	BTS-27K	

† Items R64A, R64B, C58A, C58B
♦ Items R75A, R75B, R75C, C63A

TRANSFOR

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	Wells-Gardner PART No.	Stan PART
T1	117VAC	606VCT	5VAC	53X339A	P-83
	② 1. 7A	. 250ADC	② 3A		
	SEC. 3	SEC. 4	SEC. 5		
	6. 3VAC ② 9. 3A				

① Tape small 6. 3 volt winding.
② Tape low voltage tape on HV secondary, also low ampere

TRANSFORMERS

ITEM No.	USE	Wells-Gardner PART No.	Halldorson PART No.	M PART
T2	Vert. Osc. Trans.	54X10	B6702	A-30
T3	Horiz. Output Trans.	53X330	FB411 & RF800* ①	HVO- MWC
T4	Vert. Output Trans.	51X168	Z1806 ①	A-30
T5A	Yoke-Horiz. (13. 5MH)	9A2334-1	DF602 ②	MDF
B	Vert. (46MH)			
T6	Horiz. Lin. Coil (1. 2-6. 6MH)	9A2262	RF800 ③④	MWC
T7	Width Coil (. 1-. 6MH)	9A2183		

① Drill new mounting hole(s).
② Use original yoke damping network.
③ Enlarge mounting hole.
④ Connect to terms #3 & #4.
⑤ Connect to coded blue and green terms.
⑥ Drill new mounting hole or use original bracket, slider an

*HORIZONTAL OUTPUT TR

Use Original Width Coil

	ORIGINAL TERMINAL CONNECTIONS	Halldorson Replacement Connections	Merit Replacement Connections	Repla Conn
	6	9	9	1
	5	7	7	8
	4	5	5	7
	3	See Note ⑦	See Note ⑦	See ⑥
	2	3	3	3
	1	1	1	5
	A	RF800 Term #3	MWC-1 Orange Term	4
	G	RF800 Term #4	MWC-1 Black Term	1
Connect Width Coil Across →	2 & 1	RF800 Terms #1 & #2 across 3 & 1	MWC-1 Terms Red & Blue across 3 & 1	2L acr 2 &
Special Notes →		⑦ ⑩	⑦ ⑩	⑥

⑦ Connect a 47 or 56MMF capacitor from terminal #5 to
⑧ Connect a 47 or 56MMF capacitor from terminal #7 to
⑨ Connect a 47 or 56MMF capacitor from terminal "T"
⑩ If the picture is out of phase, reverse width coil prim
⑪ Jumper terms #9 & "T".

CAPACITORS (cont)

ITEM No.	RATING CAP	RATING VOLT	REPLACEMENT DATA Wells-Gardner PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	NOTES
C56	.0047	400	RCP10M4472M	D6-472	GP2-333-472	PT6347	IMPE-D47	3306347	
C57	5000		47Z50T	DD-503	811-006	DC-535	IMPE-D5	C-1350	
C58A	10000								
B			†76X5	†PC-80	†1404-01				
C	250								
C58	.0047	600	RCP10M6472M	D6-472	GP2-333-472	PT6347	IMPE-D47	3306347	
C59	.01	400	RCP10M4103M	D6-103	GP2-333-103	PT611	IMPE-D1	330411	
C61	1000		80X1	DD-101	801-001	DC-531	IMPE-D1	K-1310	
C63	.047	400	RCP10M4473M	D7-503		PT6147	IMPE-D47	3306147	
C63A	2000					DC-532	IMPE-D2	C-1330	
B	5000		▪76X7	▪PC-100	▪1406-01	DC-533	IMPE-D5	C-1350	
C	5000					DC-535	IMPE-D5	C-1350	
C64	4700	500	47X542			MC2465		CR-1247	
C65	.022	300	RCP10M3223M	DF-303	817-02	PT6132	IMPE-P32	3306132	
C66	.047	600	RCP10M6473M	DF-503		PT6147	IMPE-D47	3306147	
C67	.022	200	RCP10M2223M	DF-303	817-02	PT6132	IMPE-P32	3306132	
C68	.1	600	RCP10M6104M	DF-104		PT601	IMPE-P1	330601	
C69	.047	600	RCP10M6473M	DF-503		PT6147	IMPE-D47	3306147	
C70	.015	600	RCP10M6153M			PT6145	IMPE-D15	3306145	
C71	1000		80X1	DD-101	801-001	DC-531	IMPE-D1	K-1310	
C73	1000		80X1	DD-101	801-001	DC-531	IMPE-D1	K-1310	
C73	.01	400	RCP10M4103M	D6-103	GP2-333-103	PT611	IMPE-D1	330411	
C74	270	500	RCM30A271K	D6-271	GP2K-271	MC241		K-1327	
C75	.0047	400	RCP10M4473M	D6-472	GP2-333-472	PT6347	IMPE-D47	3306347	
C76	.047	300	RCP10M3473M	DF-503		PT6147	IMPE-D47	3303147	
C77	4700	500	47X543			MC2465		CR-1247	
C78	390	500	RCM30B391J			MC2643		KR-1339	
C79	.1	400	RCP10M4104M	DF-104		PT601	IMPE-P1	330401	
C80	330	500	47X370					KR-1333	
C81	.047	400	RCP10M4473M	DF-503		PT6147	IMPE-D47	3306147	
C82	.1	400	RCP10M4104M	DF-104		PT601	IMPE-P1	330401	
C83	.047	400	RCP10M4473M	DF-503		PT6147	IMPE-D47	3306147	
C84	.15	400	RCP10M4154M			PT6015	IMPE-P15	3304115	
C85	500	10000	47Z505	TVY-503	413	HV-30055A			
C86	10000		47Z615	DD-103	811-01	DC-511	IMPE-S1	330611	
C87	10000		47Z615	DD-103	811-01	DC-511	IMPE-S1	330611	

† Items C58A, C58B, C58C, R64A and R64B are combined in one unit.
When replacing items separately C58B and C58C should total 250MMF.
• Items C63A, C63B, C63C, R75A, R75B, and R75C are combined in one unit.

CONTROLS

ITEM No	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA Wells-Gardner PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	100Ω	½	B103X	*QJ-536	RTV-503	F1-4	UF13L	Contrast - Panel
B	1Meg	½				R2-59	UR16-7254	Volume tapped at 250kΩ - Rear
C	Switch					KS-3	US-27	Attach to R1B
R2A	50kΩ	½	B40X361-C	Q11-123	A47-50K-S	AB-31	U-35	Horiz. Hold
B	Shaft		Not Req.	NQ	R8-3/8	AK-4	Not Req.	Attach to R2A
R3A	1.5Meg	½	B40X334-E	Q11-136	A47-1.5Meg-S	AB-75	U-155	Tone
B	Shaft		Not Req.	NQ	R8-3/8	AK-4	Not Req.	Attach to R3A
R4A	500kΩ	½	B40X335-A	Q11-123	A47-500K-S	AB-59	U-50	Brightness
B	Shaft		Not Req.	Not Req.	R8-3/8	AK-4	Not Req.	Attach to R4A
R5A	1.5Meg	½	B40X334-E	Q11-136	A47-1.5Meg-S	AB-75	U-155	Vert. Hold
B	Shaft		Not Req.	NQ	R8-3/8	AK-4	Not Req.	Attach to R5A
R6A	7.5Meg	½	B40X370A	Q11-143	A47-7.5Meg-S	AB-89	U-93	Sync Stability
B	Shaft		Not Req.	Not Req.	FK8-1/4	AK-4	Not Req.	Attach to R6A
R7A	500Ω	½	B40X375	Q11-116	A47-10K-S	AB-31	U-30	Vert. Linearity
B	Shaft		Not Req.	BQ	FK8-1/4	AK-1	Not Req.	Attach to R7A
R8A	2.5Meg	½	B40X368A	Q11-139	A47-2.5Meg-S	AB-83	U-86	Height
B	Shaft		Not Req.	BQ	FK8-1/4	AK-4	Not Req.	Attach to R8A
R9A	2.5Meg	½	B40X368A	Q11-139	A47-2.5Meg-S	AB-83	U-86	AGC
B	Shaft		Not Req.	BQ	FK8-1/4	AK-4	Not Req.	Attach to R9A

* CONCENTRIKIT EQUIVALENT: KIT K-4, BASE ELEMENTS & SHAFTS: B11-108 & P6-218 (PANEL)
B13-137X & R16-315 (REAR)
76-2 SWITCH

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Wells-Gardner PART No.	IRC PART No.	NOTES
R10	47kΩ	½	Not Req.	BTS-47K	
R11	22kΩ	½		BTS-22K	
R12	820kΩ	½		BTS-820K	
R13	150kΩ	½		BTA-150K	
R14	470kΩ	½		BTS-470K	
R15	100kΩ	½		BTS-100K	
R16	100kΩ	½		BTS-100K	
R17	100kΩ	½		BTS-100K	
R18	82000Ω	½		BTS-8200	
R19	6800Ω	½		BTS-6800	
R20	10kΩ	½		BTS-10K	
R21	3300Ω	1		BTA-3300	
R22	33000Ω 5%	½		BTS-3300 5%	
R23	470 5%	½	B83470	BTS-47 5%	
R24	470Ω	½	B85471	BTS-470	
R25	1000Ω	½	B85102	BTS-1000	
R26	39K0 5%	½	B83393	BTS-39K 5%	
R27	470 5%	½	B83470	BTS-47 5%	
R28	470Ω	½	B85471	BTS-470	
R29	150Ω	½	B85151	BTS-150	
R30	39K0 5%	½	B83393	BTS-39K 5%	
R31	180Ω	½	B84181	BTS-180	
R32	1500Ω	½	B84152	BTS-1500	
R33	150Ω	½	B85151	BTS-150	
R34	39000 5%	½	[redacted]	BTS-3900 5%	
R35	5600Ω	½	C84562	BTA-5600	
R36	1500Ω	½	B84152	BTS-1500	
R37	33kΩ	½	B84333	BTS-33K	
R38	1Meg	½	B84105	BTS-1Meg	
R39	68Ω	½	B84680	BTS-68	
R40	3000Ω 5%	2	[redacted]	BTB-3000 5%	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Wells-Gardner PART No.	IRC PART No.	NOTES
R41	2000Ω 5%	½	B84202	BTS-2000 5%	
R42	100kΩ	½	B84104	BTS-100K	
R43	1Meg	½	B84105	BTS-1Meg	
R44	22kΩ	½	B84223	BTS-22K	
R45	100kΩ	½	B85304	BTS-100K	
R46	47kΩ	½	B85473	BTS-47K	
R47	47kΩ	½	B84473	BTS-47K	
R48	470kΩ	½	B84474	BTS-470K	
R49	2.7Meg	½	B84275	BTS-2.7Meg	
R50	330kΩ	½	B83334	BTS-330K	
R51	100kΩ	½	B84104	BTS-100K	
R52	100Ω	½	B84101	BTS-100	
R53	1000Ω	½	B85102	BTS-1000	
R54	56kΩ	½	B84563	BTS-56K	
R55	33kΩ	½	B84333	BTS-33K	
R56	1000Ω	½	B85102	BTS-1000	
R57	33kΩ	½	B84333	BTS-33K	
R58	270Ω	½	B84271	BTS-270	
R59	68kΩ	½	B84683	BTS-68K	
R60	10kΩ 5%	½	B83103	BTS-10K 5%	
R61	10kΩ 5%	½	B83103	BTS-10K 5%	
R62	68kΩ	½	B84683	BTS-68K	
R63	10Meg	½	B85106	BTS-10Meg	
R64A	500kΩ	½		BTS-470K	
B	500kΩ		†76X5	BTS-470K	
R65	330Ω	1	C84331	BTA-330	
R66	1000Ω	2	D84102	BTB-1000	
R67	47kΩ	½	B84473	BTS-47K	
R68	10kΩ	½	B84103	BTS-10K	
R69	270kΩ	½	B84274	BTS-270K	
R70	68kΩ	½	B84683	BTS-68K	

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS (cont)

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Wells-Gardner PART No.	IRC PART No.	NOTES
R71	1.5Meg	½	B84155	BTS-1.5Meg	
R72	820kΩ	½	B84824	BTS-820K	
R73	33000Ω 5%	½	B83332	BTS-3300 5%	
R74	33000Ω 5%	½	B83332	BTS-3300 5%	
R75A	22kΩ	½		BTS-22K	
B	82000Ω		•76X7	BTS-8200	
C	82000Ω			BTS-8200	
R76	82kΩ	½	B84323	BTS-82K	
R77	3.3Meg 5%	½	B84335	BTS-3.3Meg 5%	
R78	22kΩ	½	B84223	BTS-22K	
R79	1.5Meg	½	B84155	BTS-1.5Meg	
R80	2.2Meg	½	B84225	BTS-2.2Meg	
R81	200kΩ 5%	½		BTS-200K 5%	
R82	82000Ω	½	B84823	BTS-8200	
R83	2.2Meg	½	B84225	BTS-2.2Meg	
R84	820Ω	½	B84821	BTS-820	
R85	22000Ω	½	B84223	BTS-2200	
R86	56Ω	½		BTS-560	
R87	100kΩ	½	B84104	BTS-100K	
R88	4.7Meg	½	B85475	BTS-4.7Meg	
R89	100kΩ	½	B84104	BTS-100K	
R90	27kΩ	½	B84273	BTS-27K	

† Items R64A, R64B, C58A, C58B and C58C are combined in one unit.
• Items R75A, R75B, R75C, C63A, C63B and C63C are combined in one unit.

TRANSFORMER (POWER)

ITEM No.	RATING PRI	RATING SEC 1	RATING SEC 2	REPLACEMENT DATA Wells-Gardner PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	RCA TYPE No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC @ 1.7A	806VCT 5VAC @ 3A		53X339A	P-8393①				P9715 ③	
	SEC 3	SEC 4	SEC 5							
	6.3VAC @ 8.3A									

① Tape small 6.3 volt winding.
② Tape low voltage tape on HV secondary, also low ampere 6.3 volt winding.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No	USE	REPLACEMENT DATA Wells-Gardner PART No	Halldorson PART No	Merit PART No.	RCA TYPE No.	Ram PART No.	Stancor PART No	Thordarson PART No	Triad PART No.
T2	Vert. Osc. Trans.	54X10	B6702	A-3003	209T1 ①	V405	A-8325	24A87 ①	A-97X
T3	Horiz. Output Trans.	53X330	F3411 ④	HVO-9 ④	235T1 ④	X110•	A-8237 ④	F1J-24 ④	D-35 ④
			RF800• ①	MWC-1•①	212R1•①		WC-8•①	WC-30•①	WC-12•①
T4	Vert. Output Trans.	51X168	Z1806 ②	A-3039①	226T1 ①	V312 ①	A-8241 ①	26B54 ①	A-104X ①
T5A	Yoke-Horiz. (13.5MH)	8A2354-1	DF803 ③	MDF-73①	31ID2 ③	Y70F14 ③	DY-8A ③	Y-4 ③	Y-17 ③
B	Vert. (46MH)								
T6	Horiz.Lin.Coil								
		(L2-4.6MH)	RF800 ①④	MWC-4①	213R1	201R16	WC-8	WC-32	WC-12 ③
T7	Width Coil (1.6MH)	8A2183			201R4 ④	201R4 ④	WC-1 ④	WC-15 ④	

① Drill new mounting hole(s).
② Use original yoke damping network.
③ Enlarge mounting hole.
④ Connect to terms #3 & #4.
⑤ Connect to coded blue and green terms.
⑥ Drill new mounting hole or use original bracket, slider and core.

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

ORIGINAL TERMINAL CONNECTIONS	Halldorson Replacement Connections	Merit Replacement Connections	RCA Replacement Connections	Ram Replacement Connections	Stancor Replacement Connections	Thordarson Replacement Connections	Triad Replacement Connections
	6	9	9	10	13	7	9	10
					Jumper			
	5	7	7	8	10 & 11	4	7	8
	4	5	5	7	6	7	5	7
	See Note ②	See Note ②	See Note ②	See Note ⑤	4	See Note ③	See Note ③	See Note ⑤
	3	①	①	⑤		See Note ③	①	⑤
	2	3	3	NC	2	2	3	NC
	1				1	1	1	3
	A	RF800 Term #3 Orange Term	MWC-1 Orange Term	2	8	WC-20 Orange Term	WC-30 Term #2	2
	RF800 Term #4	MWC-1 Black Term	MWC-4	1	8	WC-8 Black Term	WC-32 Term #2	1
Connect With Coil Across	RF800 Terms #1 & #2 across 3 & 1	MWC-1 Terms Red & Blue across 3 & 1	212R1 across 2 & 1	WC-5 terms Red & Blue across 3 & 1	WC-30 Terms #3 & #4 across 3 & 1	WC-12 Terms Red & Blue across 2 & 1	
2 & 1							
Special Note:	⑦ ⑫	⑦ ⑫	⑧	⑨ ⑩	⑦ ⑩	⑦ ⑩	⑪

① Connect a 47 or 56MMF capacitor from terminal #5 to open end of R107. (Original terminal #3 connection.)
② Connect a 47 or 56MMF capacitor from terminal #1 to open end of R107. (Original terminal #3 connection.)
③ Connect a 47 or 56MMF capacitor from terminal "T" to open end of R107. (Original terminal #3 connection.)
④ If the picture is out of phase, reverse width coil primary or secondary.
⑤ Jumper terms #3 & "T".

TRANSFORMER (AUDIO OUTPUT)

ITEM No	IMPEDANCE PRI	IMPEDANCE SEC	REPLACEMENT DATA Wells-Gardner PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	NOTES
T8	5.1KC	3.4Ω	51X166	A-3877	A-2930	S-3X	Z1107	24B51	

SPEAKER

ITEM No.	RATINGS SIZE	RATINGS FIELD	RATINGS V. C. IMP	REPLACEMENT DATA Wells-Gardner PART No.	QUAM PART No.	NOTES
SP1	10"	PM	3.4Ω	12A519	10A31	
	8"	PM	3.4Ω	12A518	8A31	
	6"	PM	3.4Ω	12A516	6A31	

COILS (RF-IF)

ITEM No.	USE	DC RES PRI.	DC RES SEC.	REPLACEMENT DATA Wells-Gardner PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1A	Ant. Coil	00CT	0Ω	9A2329-2				Channel 2
H	Ant. Coil	00CT	0Ω	9A2329-3				Channel 3
C	Ant. Coil	00CT	0Ω	9A2329-4				Channel 4
D	Ant. Coil	00CT	0Ω	9A2329-5				Channel 5
E	Ant. Coil	00CT	0Ω	9A2329-6				Channel 6
F	Ant. Coil	00CT	0Ω	9A2329-7				Channel 7
G	Ant. Coil	00CT	0Ω	9A2329-8				Channel 8
H	Ant. Coil	00CT	0Ω	9A2329-9				Channel 9
I	Ant. Coil	00CT	0Ω	9A2329-10				Channel 10
J	Ant. Coil	00CT	0Ω	9A2329-11				Channel 11
K	Ant. Coil	00CT	0Ω	9A2329-12				Channel 12
L	Ant. Coil	00CT	0Ω	9A2329-13				Channel 13
L2	Neut. Coil	0Ω		31B-727				
L3A	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-2				Channel 2
B	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-3				Channel 3
C	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-4				Channel 4
D	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-5				Channel 5
E	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-6				Channel 6
F	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-7				Channel 7
G	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-8				Channel 8
H	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-9				Channel 9
I	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-10				Channel 10
J	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-11				Channel 11
K	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-12				Channel 12
L	RF, Mixer Grid & Osc. Coils	0Ω		9A2330-13				Channel 13
L4	Fil. Choke	0Ω		34A-704				
L5	Conv. Plate	.1Ω		31K-109				
L6	IF Trap	.1Ω		9A2320				
L7	1st Video IF	.3Ω		9A2216				
L8	2nd Video IF	.3Ω	.2Ω	9A2317		TV-126		5318	Includes 47.25MC trap
L9	FIL Choke	0Ω		9A2033	19-1003			4606	
L10	3rd Video IF	.3Ω	.2Ω	9A2318		TV-128•		6339•	
L11	Parasitic Suppressor	0Ω		9A2323					1 turn wire on 10Ω resistor
L12	Fil. Choke	0Ω		9A2033	19-1003			4606	
L13•	Cathode Trap	0Ω		9A2321					
L14	4th Video IF	.5Ω	.5Ω	9A2319		TV-125		6334	
L15	Series Peaking Coil	8Ω		36A10		19-4060		6172▲	60 Microhenries; Wound on 22kΩ resistor
L16	Shunt Peaking Coil	18Ω		36A22		19-3300	TV-185	6184	200 Microhenries
L17	4.5MC Trap	.3Ω		9A3074	30-1004		TV-181	1470	
L18	Shunt Peaking Coil	10.5Ω		36A1		19-3300	TV-181	6177	100 Microhenries
L19	Shunt Peaking Coil	10.5Ω		36A35		19-3300▲	TV-181▲	6177▲	100 Microhenries; Wound on 470Ω resistor
L20	Series Peaking Coil	14Ω		36A12		19-4150▪	TV-184▪	6180▪	160 Microhenries; Wound on 22kΩ resistor
L21	Shunt Peaking Coil	14Ω		36A2		19-3180	TV-184	6154	180 Microhenries
L22	1st Sound IF	6.5Ω		9A2301		17-1051•	TV-113▪	6203▪	
L23	2nd Sound IF	2.6Ω	2.1Ω	9A2323		17-1021	TV-113	6203	
L24	Ratio Det.	4Ω	.8OCT	9A2395		17-3497	TV-115	6205	Tertiary winding = .5Ω
L25	Horiz. Osc.	64Ω		9A3096		19-1870	TV-163	6310	

• Detune Osc.
▪ Parallel with 22kΩ resistor.
▲ Parallel with 470kΩ resistor.
• Drill mounting holes.
▪ Use one winding only.

PARTS LIST AND DESCRIPTIONS (Continued)

FILTER CHOKE

ITEM No.	RATINGS			REPLACEMENT DATA					
	TOTAL DIRECT CURRENT	D. C. RESISTANCE	INDUCTANCE (0 CURRENT 1000 ∿)	Wells-Gardner PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
L26	.250ADC	38. 6Ω	1. 06HY	52X95	C-2326 ①	C-2996 ①	C-23X①	C5037①	26C44

① Drill one new mounting hole.

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Wells-Gardner PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG S/B	4/10A 125V	16X147-3	16X146	313. 400 (3AG-4/10A-S/B)	357091	MDL 4/10	4405

MISCELLANEOUS

ITEM No.	PART NAME	Wells-Gardner PART No.	NOTES
M2	Dial Light	7A32	#51, Bayonet
M3	Tuner	25A1119	VHF
M4	Trap	31K-225-01	VHF Ant. Input Filter
M5	Focus Magnet	2A438-2	Includes centering device
M6	Ion Trap	2A421	
B2	Trimmer Cap.	17A269	Horizontal Drive (120-400MMF)
	Knob	10A820-1	Fine tuning - Mahogany cabinet
	Knob	10A840-1	Contrast - Mahogany cabinet
	Knob	10A812-1	Channel Selector - Mahogany cabinet
	Knob	10A841-1	On-off-volume -
	Knob	10A820-2	Fine tuning - Oak cabinet
	Knob	10A840-2	Contrast - Oak cabinet
	Knob	10A812-3	Channel Selector - Oak cabinet
	Knob	10A841-2	On-off-volume - Oak cabinet
	Knob	10A826	Red- Secondary controls
	Safety Glass	17X180	Specify complete model number when ordering
	Mask	4X1230-6	Specify complete model number when ordering

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

TROUBLE SHOOTING AIDS (cont)

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V18, V19, V20 and V21. Check waveform W18.

If Satisfactory	If Unsatisfactory
Check T3, T5A, T6, T7, C83, C82, C84, C81, R102, R103 and other associated components.	Check L25, C77, C78, R97, R95, R94 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V19, V20, and V22. Check adjustment B2, B3 and B4. Check T3, T5A, R102, R103, R97 and other associated components.

BLOOMING

Check by substitution V19, V20, V21 and V22. Check R109, R102, R103, C84 and other associated components.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video".

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or No Sound".

RASTER, NO SOUND, NO PICTURE

Check by substitution V1, V2, V3, V4, V5, V6, V7, V8 and V9. Check video IF components for failure or change of value.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set".

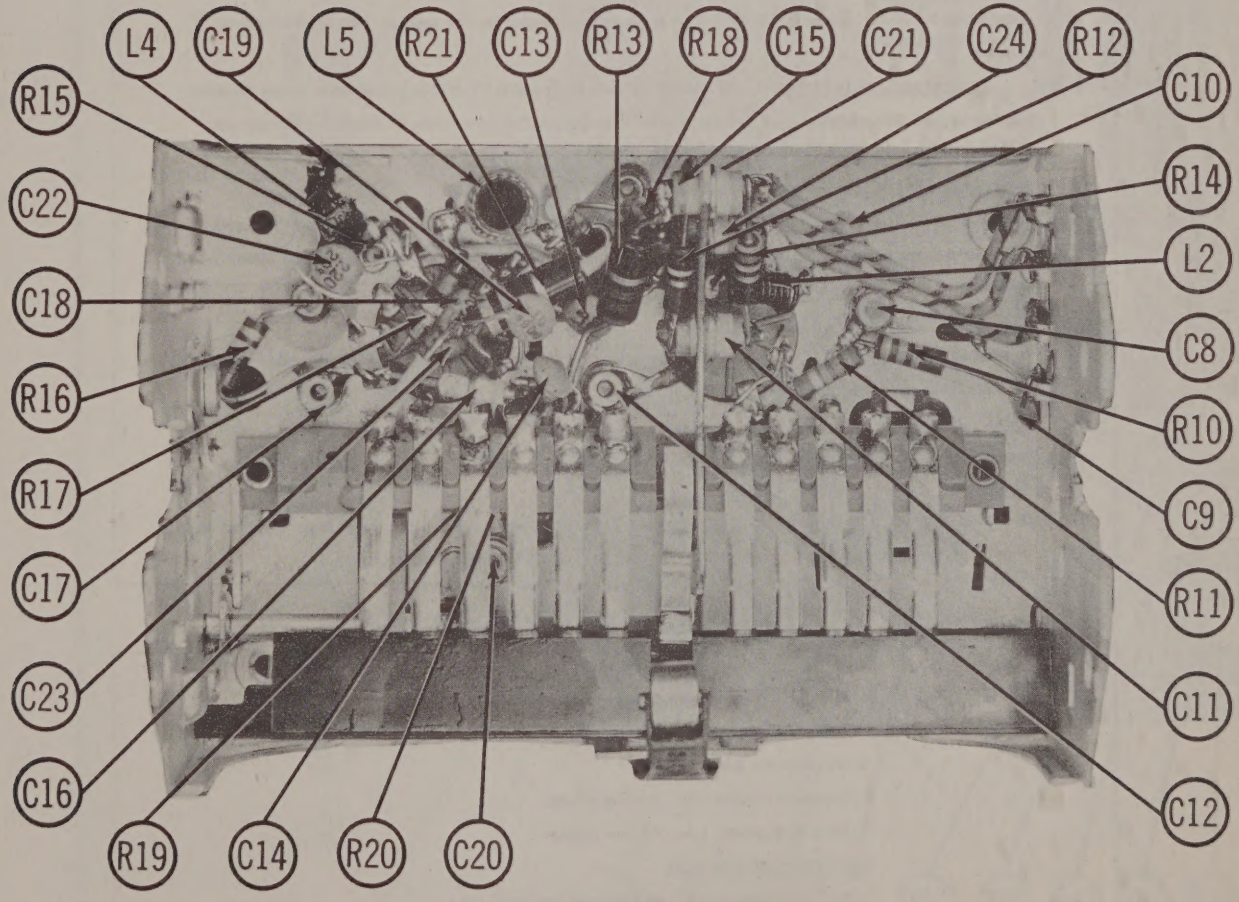
KEYSTONE EFFECT

Check T5 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



TUNER BOTTOM VIEW

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

Touch-up adjustments of the VHF tuner oscillator circuit may be accomplished by removal of the channel selector and fine tuning knobs. The adjustments are accessible, one at a time, thru the small hole in the cabinet above and slightly to the left of the channel switch.

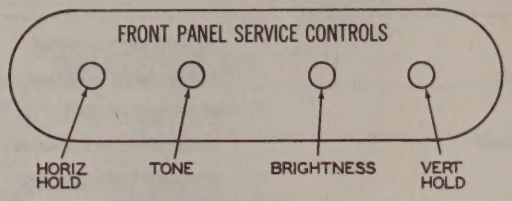
PICTURE TUBE SAFETY GLASS CLEANING

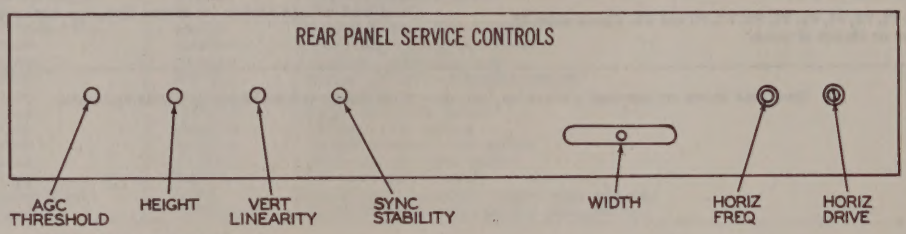
To clean safety glass, remove 5 wood screws holding plastic strip at the top of the safety. Remove plastic strip and safety glass. Use extreme caution when removeing safety glass.

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION





SPECIAL ADJUSTMENTS

AGC THRESHOLD - Turn the set on and tune in strongest station in that area. Turn the AGC Threshold Control (R9) clockwise until the picture shows signs of overloading, faded out picture and buzz in sound. Turn R9 counter clockwise from the point where overloading occurs until no sign of overloading is noted.

SYNC STABILITY CONTROL - Turn set on and tune in strongest TV station in that area. Rotate the sync stability control (R6).clockwise until bending is noted near the top of picture. Turn R6 counter clockwise until picture bending disappears.

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

Adjustment of horizontal oscillator circuit can be made from the rear panel of the chassis. Set the horizontal hold control at the mid-range position and adjust the horizontal frequency slug (L25) until the picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz adjust the ratio detector secondary (L24) located on top of chassis (See tube placement chart for location).

FUSES

One fuse is used for LV power supply protection.(For location see tube placement chart).

CENTERING

Centering is accomplished mechanically by means of a centering lever on the PM focusing assembly. Adjust the centering lever from side to side, and up and down until the picture is properly centered.

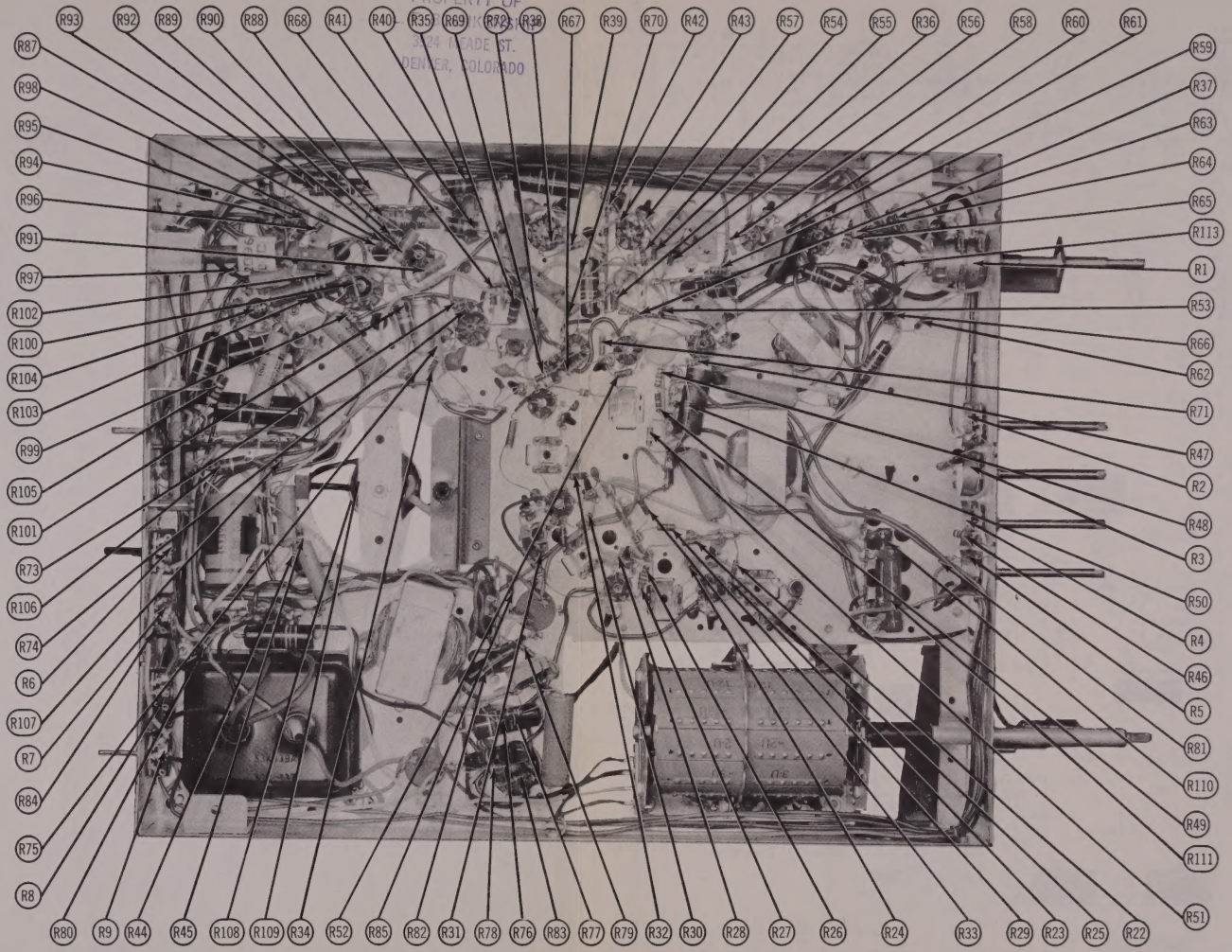
DISASSEMBLY INSTRUCTIONS

1. Remove 4 push-on type control knobs from front panel of cabinet.
2. Remove 4 metal screws. Remove rear cover.
3. Remove 2 metal screws from antenna leads.
4. Disconnect 2 antenna leads.
5. Remove 4 chassis bolts. Remove chassis.
6. Remove 4 speaker nuts. Remove speaker.

PICTURE TUBE REMOVAL

1. Remove 1 metal screw from front tube mounting band.
2. Remove picture tube socket and HV lead and ion trap.
3. Remove picture tube.

PROPERTY OF
[illegible]
3224 MEADE ST.
DENVER, COLORADO



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION